

WAUBEEKA LAKE DAM

CT 00065

CONNECTICUT COASTAL BASIN

DANBURY, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JULY 1981

The original hardcopy version of this report
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New England District
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00065	2. GOVT ACCESSION NO. ADA142691	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Waubeeke Lake Dam Conn.Coastal Basin, Danbury, Conn. NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE July 1981
		13. NUMBER OF PAGES 70
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Waubeeke Lake Dam Conn. Coastal Basin Danbury, Conn.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Waubeeke Lake is fed primarily by artesian springs, and is impounded by three dikes on the western, eastern and southern shores. The dikes and lake are currently owned by the Waubeeke Lake Property Owners Assoc., Inc., Danbury, Conn. The operation and maintenance of the facility is the responsibility of Mr. Peter Couchevich, Caretaker. The lake is maintained for recreation purposes only.		



CONSULTING
ENGINEERS

INTERNATIONAL ENGINEERING COMPANY, INC.
A MORRISON-KNUDSEN COMPANY

EASTERN DISTRICT OFFICE
777 POST ROAD/DARIEN, CONNECTICUT 06820
PHONE: (203) 655-3345

1331
2616-110

July 31, 1981

Mr. E. P. Gould
Project Management Branch
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Reference: Contract No. DACW33-81-C-0015
Inspection and Evaluation of Non-Federal Dams
FY-81, Southwestern Connecticut

Dear Mr. Gould:

The inspection of Waubeeka Lake Dam and subsequent hydrologic-hydraulic investigation revealed that the dam should be classified as having a low hazard potential. The following is an abbreviated Phase I Inspection report to substantiate this classification.

Sincerely,

Reynold A. Hokenson, P. E.
Project Manager

RAH/daw

Enclosures

**PRELIMINARY
DRAFT**

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
Letter of Transmittal	
Table of Contents	
Brief Assessment	1-1
Location Map	1-5

APPENDICES

APPENDIX A - INSPECTION CHECKLIST	A-1
APPENDIX B - ENGINEERING DATA AND CORRESPONDENCE	B-1
APPENDIX C - PHOTOGRAPHS	C-1
APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS	D-1

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: CT 00065
Name of Dam: Waubeeka Lake Dam
Town: Danbury
County and State: Fairfield, Connecticut
Stream: NOT APPLICABLE
Date of Inspection: June 29 and July 14, 1981

BRIEF ASSESSMENT

Waubeeka Lake is fed primarily by artesian springs, and is impounded by three dikes on the western, eastern, and southern shores. The dikes and lake are currently owned by the Waubeeka Lake Property Owners Association, Inc., Danbury, Connecticut, (203) 743-9119. The operation and maintenance of the facility is the responsibility of Mr. Peter Couchevich, Caretaker, 404 Post Road, Danbury, Connecticut, (203) 743-9119. The lake is maintained for recreational purposes only.

The formation of what is currently known as Waubeeka Lake, occurred over a number of years. The Eastern Dike, which was the first dike constructed according to available information, was erected in 1933. Construction of the West Dike did not occur until the development of the Waubeeka Lake community commenced. The Southern Dike (landfill) was constructed to prevent flow from the lake from entering the Saugatuck River which flows into the Saugatuck Reservoir. The Saugatuck Reservoir, located 5.5 miles from the southern tip of Waubeeka Lake, is currently used as a public water supply.

The West Dike consists of a road embankment built along a natural saddle which lies between hills forming a ridge along the western and southern fringes of the lake. The upstream slope of the dike is a small beach (Waubeeka Lake Beach) which slopes to the lake's edge at about 1V:10H

(Photo 3). The top of the dike (El. 718 NGVD; Note: all elevations referenced to the National Geodetic Vertical Datum) is a 30-foot-wide two-lane paved road (Post Road). The downstream slope in the vicinity of the culvert was measured at 1V:3H and is entirely covered with small trees (2 to 6 inches in diameter) and brush (Photos 1 and 2). A 3-foot-diameter by 120-foot-long concrete culvert (Intake Invert El. 712) drains excess water build-up from the lake (Photo 4). During the summer, months the culvert intake is filled with sand to within 1.5 feet of the culvert crown to elevate the recreation pool.

The East Dike is a 225-foot-long by 3-foot-high earthfill structure with a vertical downstream masonry face and an inclined upstream face which is entirely covered with riprap (Photos 6 and 7). The top of the dike varies from El. 713.3 to El. 714.5 and is approximately 15 feet wide. This variation in elevation occurs in the vicinity of the repaired breach. During the 1955 flood, flow over the top of the dike swept away a 20 to 30-foot-wide section of the dike. This breached area was later restored and no further incidents of this nature have occurred to date. The top and downstream toe are overgrown with trees ranging from 2 to 10 inches in diameter. In addition, a two-lane paved road (Carol Street) was constructed 20 feet from the downstream face of the dike during the development of the Waubeeka Lake community. A storm drain located at the roads edge, adjacent to the dam, collects runoff and pipes it under Carol Street to a point approximately 50 feet downstream of the dike. At the time of the inspection, fine tan deposits were found at the bottom of the storm drain discharge channel (Photo 8). The origin of this material could not be identified.

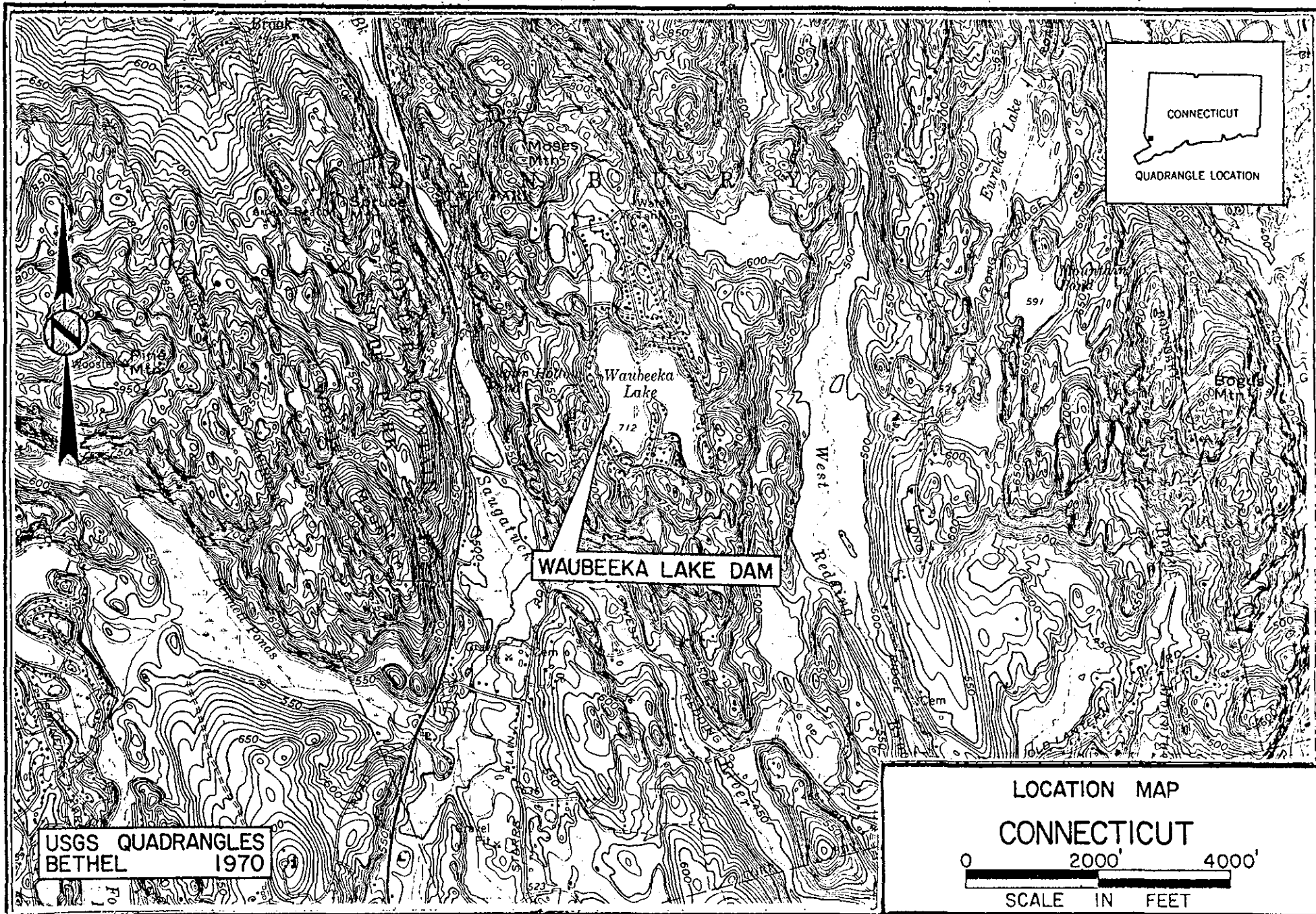
The southern Dike consists of a landfill deposited in a saddle between hills skirting the southern perimeter of the lake. The width of the South Dike is over 100 feet, while the height is only two to three feet (Photo 5). The lowest point of the South Dike is approximately El. 716.

Visual inspection of the dikes indicate that the East and West Dikes are in poor condition. The growth of trees along the dikes will deteriorate

these structures and induce seepage along the root networks. Also, high winds may uproot the larger trees, causing an immediate failure. In addition, the presence of many trees in the vicinity of a discharge channel(s) will contribute to the amount of debris in the channel(s) and impair discharge from the site(s).

The structures impounding Waubeeka Lake have a maximum storage capacity of 360 acre-feet (ac-ft). Storage capacity was based on the projected runoff from the Probable Maximum Precipitation (8.4 inches over the 0.238 square mile drainage area); the surface area of the lake at El. 712; and a maximum depth of 14 feet. The height of the structure selected for the dam breach analysis (West Dike) is 5.46 feet. Since the West Dike falls within the Corps' criteria for the small size category based on storage (between 50 and 1,000 ac-ft), the dike (dam) is considered to be SMALL in size. The dam breach analysis was conducted in accordance with the "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", dated April 1978, and the potential impact area defined. The invert of the 3-foot-diameter concrete culvert in the West Dike is 1.5 feet below the top of the East Dike. Consequently, the East Dike acts as an emergency spillway since weir flow occurs over this structure before pressure flow begins in the concrete culvert. With 1.5 feet of head on the crown of the culvert, weir flow begins over the southern Dike. Flow over the West Dike will not occur until approximately 5 feet of head is on the crown of the concrete culvert. Consequently, discharge will occur initially through the concrete culvert and over the East Dike as the lake surface rises. Since the East Dike will pass the entire Probable Maximum Flood (PMF), the water surface will never reach the top of the West Dike. As a result, the maximum water surface elevation achieved during the PMF (El. 715) was used in the dam breach analysis. The breach analysis was performed using that portion of the road embankment adjacent to the 3-foot diameter concrete culvert (see Appendix B; pg. B-3; Plan and Section). This area was selected since it has the smallest cross-section and; therefore, represents the weakest area and the most likely section to fail. Failure of the West Dike would cause the water surface within the potential impact area, immediately downstream of the

dike, to rise to 2.2 feet at a failure outflow of 730 cfs. The breach width was assumed to include the concrete culvert. The two homes in the potential impact area have first floor elevations of 3 feet and 7.5 feet above ground level. No structures are located downstream of the East Dike and a failure of the South Dike is improbable in that it is a shallow landfill deposited in a saddle between two hills. Consequently, no damage due to the breach of the structures impounding Waubeeka Lake is anticipated and the hazard classification of the West Dike, specifically, is LOW based on the dam breach analysis.



APPENDIX A

VISUAL CHECK LIST WITH COMMENTS

VISUAL INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT: Waubee Lake Dam

DATE: 6/29 & 7/14/81

TIME: 11:00 A.M.

WEATHER: Clear, 80°-85°

W.S. ELEV. 712

PARTY:

1. Reynold A. Hokenson
2. Miron Petrovsky
3. Jerry Waugh
4. Ernst Buggisch

INITIALS:

RAH
MP
JW
EB

PROJECT FEATURE:

1. West Dike
2. Concrete Culvert Intake
3. East Dike
4. South Dike
5. Concrete Culvert
6. Concrete Culvert Discharge Channel

INSPECTED BY:

RAH, EB
RAH, MP, JW
RAH, MP, JW, EB
RAH, EB
RAH, MP, JW
RAH, MP, JW

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: Concrete Culvert Intake

NAME RAH, MP, JW

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u></p> <p>a. Approach Channel</p> <p style="padding-left: 40px;">Slope Conditions</p> <p style="padding-left: 40px;">Bottom Conditions</p> <p style="padding-left: 40px;">Rock Slides or Falls</p> <p style="padding-left: 40px;">Log Boom</p> <p style="padding-left: 40px;">Debris</p> <p style="padding-left: 40px;">Condition of Concrete Lining</p> <p style="padding-left: 40px;">Drains or Weep Holes</p> <p>b. Intake Structure</p> <p style="padding-left: 40px;">Condition of Concrete</p> <p style="padding-left: 40px;">Stop Logs and Slots</p>	<p>Waubeeka Lake</p> <p>Very little of the 3 foot diameter conduit was exposed. No deterioration was noted on exposed portions. Intake filled with sand to within 1.5 feet of crown.</p> <p>Slots in conduit headwall, but no stop logs were in place.</p>

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam
PROJECT FEATURE: West Dike

DATE 6/29 & 7/14/81
NAME RAH, EB

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u>	
Crest Elevation	718.0
Current Pool Elevation	712.0
Maximum Impoundment to Date	Approximately El. 715, October, 1955
Surface Cracks	N/A
Pavement Condition	Road surface on crest intact
Movement or Settlement of Crest	None observable
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	N/A
Indications of Movement of Structural Items on Slopes	N/A
Trepassing on Slopes	Beach on upstream slope
Sloughing or Erosion of Slopes or Abutments	None

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: West Dike

NAME RAH, EB

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u> (continued)	
Rock Slope Protection - Riprap Failures	No riprap
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	None
Piping or Boils	None
Foundation Drainage Features	Unknown
Toe Drains	Unknown
Instrumentation System	Unknown

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubee Lake Dam
PROJECT FEATURE: East Dike

DATE 6/29 & 7/14/81
NAME RAH, MP, JW, EB

AREA EVALUATED	CONDITION
<u>EAST DIKE EMBANKMENT</u>	
Crest Elevation	713.3
Current Pool Elevation	712.0
Maximum Impoundment to Date	Approximately El. 715 October, 1955
Surface Cracks	N/A
Pavement Condition	N/A
Movement or Settlement of Crest	Crest varies approximately 1.2 feet in elevation.
Lateral Movement	None
Vertical Alignment	Downstream masonry bulging slightly.
Horizontal Alignment	Good
Condition at Abutment	Good, no seepage, seperation or cracking.
Indications of Movement of Structural Items on Slopes	N/A
Trepassing on Slopes	Trees ranging from 2 to 10 inches in diameter and a footpath worn along top of dam.
Sloughing or Erosion of Slopes or Abutments	None, previously repaired breach also sound.

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: East Dike

NAME RAH, MP, JW, EB

AREA EVALUATED	CONDITION
<u>EAST DIKE EMBANKMENT (continued)</u>	
Rock Slope Protection - Riprap Failures	Some areas of displaced riprap but no exposed embankment material was observed.
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Seepage in natural channel bed has deposited tan silty material.
Piping or Boils	None
Foundation Drainage Features	Unknown
Toe Drains	Unknown
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubee Lake Dam
PROJECT FEATURE: South Dike

DATE 6/29 & 7/14/81
NAME RAH, EB,

AREA EVALUATED	CONDITION
<p><u>SOUTH DIKE EMBANKMENT</u></p> <p>Crest Elevation</p> <p>Current Pool Elevation</p> <p>Maximum Impoundment to Date</p> <p>Surface Cracks</p> <p>Pavement Condition</p> <p>Movement or Settlement of Crest</p> <p>Lateral Movement</p> <p>Vertical Alignment</p> <p>Horizontal Alignment</p> <p>Condition at Abutment</p> <p>Indications of Movement of Structural Items on Slopes</p> <p>Trepassing on Slopes.</p> <p>Sloughing or Erosion of Slopes or Abutments</p> <p>Rock Slope Protection - Riprap Failures</p> <p>Unusual Movement or Cracking at or near Toes</p> <p>Unusual Embankment or Downstream Seepage</p> <p>Piping or Boils</p> <p>Foundation Drainage Features</p> <p>Toe Drains</p> <p>Instrumentation System</p>	<p>Note: The South Dike is a shallow landfill in a natural saddle between two hills. The landfill was placed to prevent flow from the lake from entering the Saugatuck River which flows into the Saugatuck Reservoir. The top width of the landfill is approximately 100 feet and is 2 to 3 feet deep.</p>

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - CONTROL TOWER</u></p> <p>a. Concrete and Structural</p> <p>General Condition</p> <p>Condition of Joints</p> <p>Spalling</p> <p>Visible Reinforcing</p> <p>Rusting or Staining of Concrete</p> <p>Any Seepage or Efflorescence</p> <p>Joint Alignment</p> <p>Unusual Seepage or Leaks in Gate Chamber</p> <p>Cracks</p> <p>Rusting or Corrosion of Steel</p>	<p>N/A</p>

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - CONTROL TOWER (continued)</u></p> <p>b. Mechanical and Electrical</p> <p>Air Vents</p> <p>Float Wells</p> <p>Crane Hoist</p> <p>Elevator</p> <p>Hydraulic System</p> <p>Service Gates</p> <p>Emergency Gates</p> <p>Lightning Protection System</p> <p>Emergency Power System</p> <p>Wiring and Lighting System in Gate Chamber</p>	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: Concrete Culvert

NAME RAH, MP, JW

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u>	
General condition of Concrete	Ends of conduit appear to be in good condition.
Rust or Staining on Concrete	Unknown
Spalling	Unknown
Erosion or Cavitation	None of exposed ends.
Cracking	Unknown
Alignment of Monoliths	Unknown - none exposed.
Alignment of Joints	Unknown - none exposed.
Numbering or Monoliths	Unknown - none exposed.
	Note: Very little of the concrete conduit was exposed; therefore, it was impossible to examine it closely.

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubee Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: Concrete Culvert Discharge Channel.

NAME RAH, MP, JW

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u></p> <p>General Condition of Concrete</p> <p>Rust or Staining</p> <p>Spalling</p> <p>Erosion or Cavitation</p> <p>Visible Reinforcing</p> <p>Any Seepage or Efflorescence</p> <p>Condition at Joints</p> <p>Drain Holes</p> <p>Channel</p> <p>Loose Rock or Trees Overhanging Channel</p> <p>Condition of Discharge Channel</p>	<p>Loose rocks and overhanging trees 2 to 6 inches in diameter, were found in and adjacent to the channel. Additional 3-foot diameter concrete culverts are within the channel and support private driveways.</p> <p>Poor.</p>

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

PROJECT FEATURE: _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SPILLWAY WEIR, APPROACH</u> <u>AND DISCHARGE CHANNELS</u></p> <p>a. Approach Channel</p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Approach Channel</p> <p>b. Weir and Training Walls</p> <p>General Condition of Concrete</p> <p>Rust or Staining</p> <p>Spalling</p> <p>Any Visible Reinforcing</p> <p>Any Seepage or Efflorescence</p> <p>Drain Holes</p> <p>c. Discharge Channel</p> <p>General Condition</p> <p>Loose Rock Overhanging Channel</p> <p>Trees Overhanging Channel</p> <p>Floor of Channel</p> <p>Other Obstructions</p>	<p>N/A</p> <p>N/A</p> <p>N/A</p>

PERIODIC INSPECTION CHECK LIST

PROJECT: Waubeeka Lake Dam

DATE 6/29 & 7/14/81

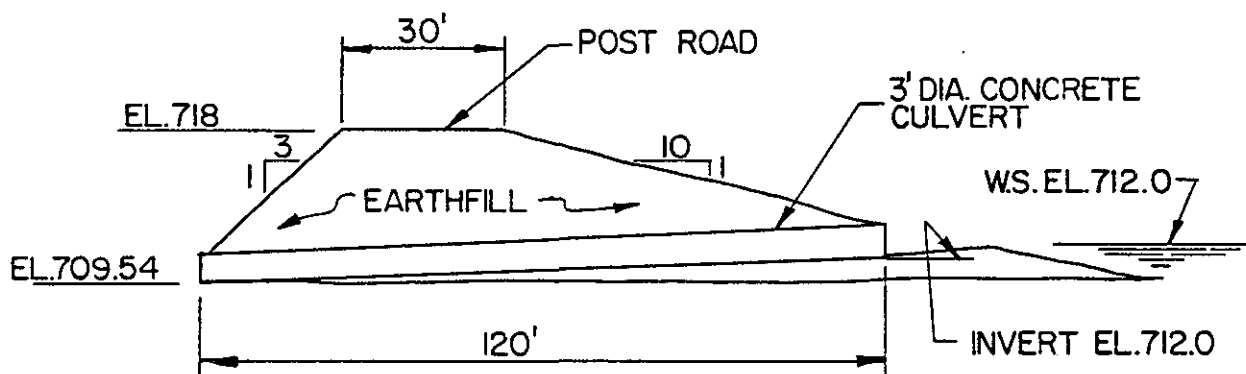
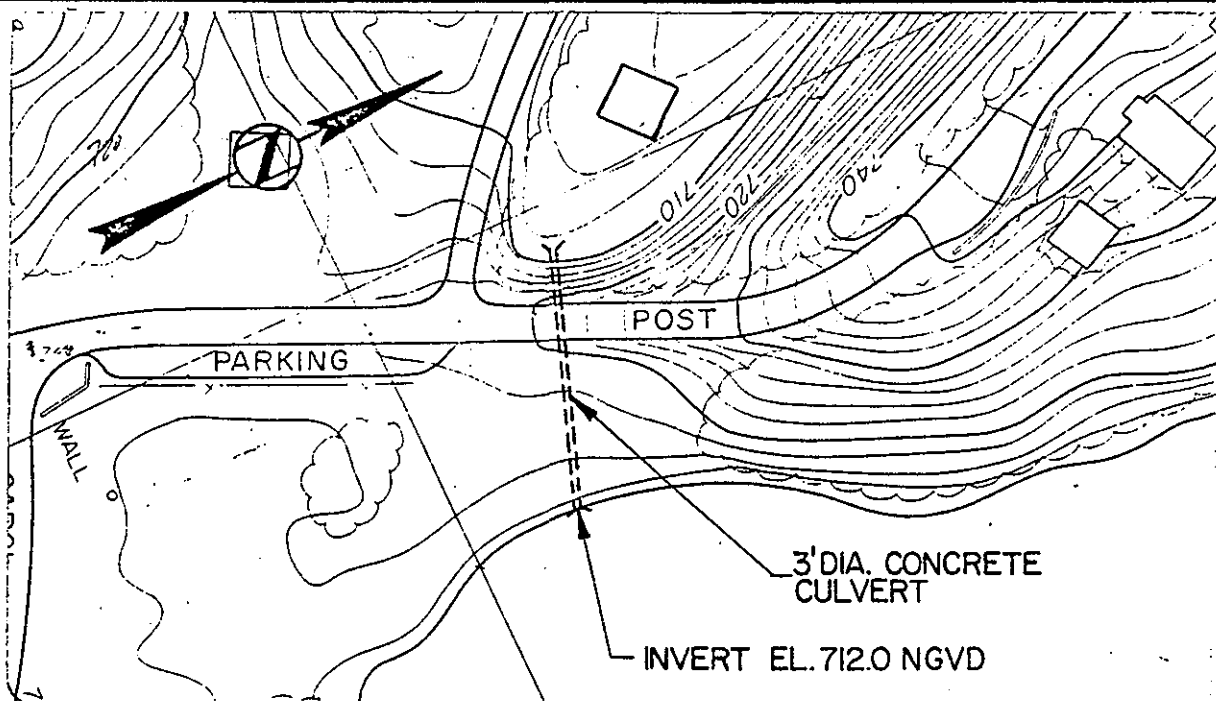
PROJECT FEATURE: _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - SERVICE BRIDGE</u></p> <p>a. Super Structure</p> <p>Bearings</p> <p>Anchor Bolts</p> <p>Bridge Seat</p> <p>Longitudinal Members</p> <p>Under Side of Deck</p> <p>Secondary Bracing</p> <p>Deck</p> <p>Drainage System</p> <p>Railings</p> <p>Expansion Joints</p> <p>Paint</p>	N/A
<p>b. Abutment & Piers</p> <p>General Condition of Concrete</p> <p>Alignment of Abutment</p> <p>Approach to Bridge</p> <p>Condition of Seat & Backwall</p>	N/A

APPENDIX B

ENGINEERING DATA



WEST DIKE SECTION
NOT TO SCALE

INTERNATIONAL ENGINEERING CO. DARIEN, CONNECTICUT ENGINEER			U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.		
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS PLAN AND SECTION WAUBEEKA LAKE DAM DANBURY, CONNECTICUT					
DWN. BY	CKD. BY	APP. BY	SCALE: AS SHOWN		
H. Holman	FAB		DATE: JULY 1981		SHEET: B - 1

SUMMARY OF CORRESPONDENCE

<u>DATE</u>	<u>TO</u>	<u>FROM</u>	<u>SUBJECT</u>	<u>PAGE</u>
--	---	---	Water Resources Inventory Data Sheet	B-4
9/26/66	Mr. Milton Livingston Secretary The Lake Waubeeka Property Owner's, Inc. Danbury, Connecticut	William P. Sanders Engineer - Geologist State of Connecticut	Recommendations following State inspection	B-6
9/26/66	Water Resources Commission State of Connecticut	A.M. McKenzie Civil Engineer	Inspection of repairs	B-7
9/8/66	A.M. McKenzie	William P. Sanders	Request to revisit site	B-8
9/7/66	William P. Sanders	Milton Livingston	Progress of repairs	B-9
8/8/66	Milton Livingston	William P. Sanders	Recommendations	B-10
7/25/66	Lake Waubeeka Property Owner's, Inc.	William H. O'Brien III	Progress of repairs	B-12
5/23/66	William H. O'Brien III	H. Rooner	Confirmation of inspection	B-13
3/29/66	Lake Waubeeka Property Owner's, Inc.	William H. O'Brien III	Recommendations	B-14
8/1/66	William H. O'Brien III State of Connecticut Water Resources Commission	Milton Livingston	Question concerning letter received from W.H. O'Brien	B-11

SUMMARY OF CORRESPONDENCE (Continued)

<u>DATE</u>	<u>TO</u>	<u>FROM</u>	<u>SUBJECT</u>	<u>PAGE</u>
3/11/66	Water Resources Commission	A.M. McKenzie	Inspection report and photos	B-15
2/21/66	A.M. McKenzie	William P. Sanders	Notice to proceed with inspection	B-28

No. _____

WATER RESOURCES UNIT
SUPERVISION OF DAMS
INVENTORY DATA

Inventoried

By _____

Date _____

Lat: 41° 20.9'

Long: 73° 27.8'

watershed = 145 acres

Name of Dam or Pond WAUBEKA LAKE

Code No. _____

Nearest Street Location _____

Town Danbury

U.S.G.S. Quad Bethel

Name of Stream West Redding Brook

Owner Lake Waubeeka Property Owners, Inc.

Address Peter Dotti, President

291 Water Street (256 Carol Street)

Perth Amboy, NJ (Lake Waubeeka)

1933?

Pond Used For _____ Drainage Area .17 sq.mi.

Dimensions of Pond: Width _____ Length _____ Area 35 ac.

Total Length of Dam w140' s80' e 50' Length of Spillway w=3' s= e=

Location of Spillway w/s/e

Height of Pond Above Stream Bed w15' s2' e5'

Height of Embankment Above Spillway w3' s2' e 0' at washout; 1' generally

Type of Spillway Construction 36" concrete pipe

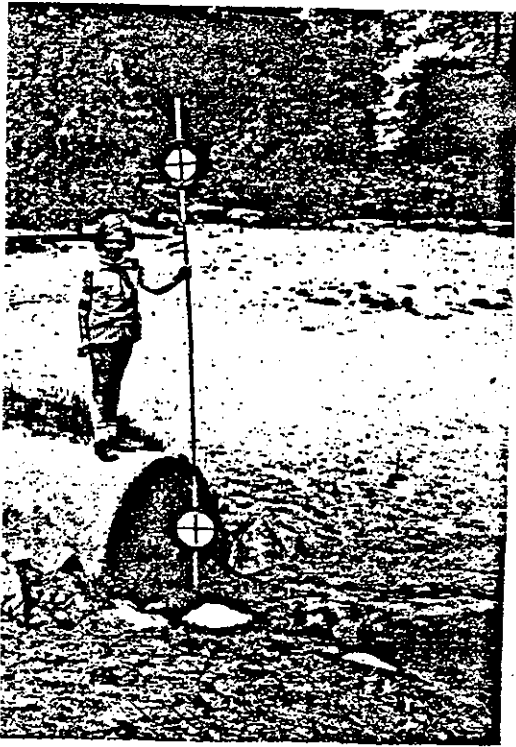
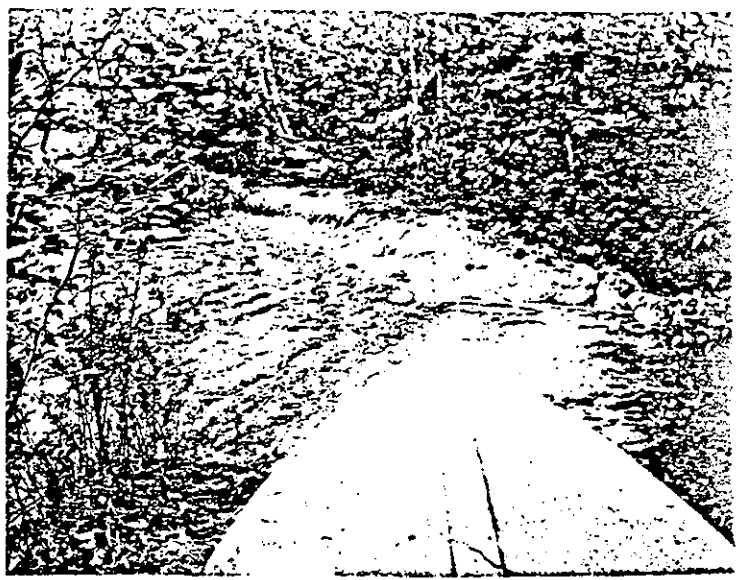
Type of Dike Construction earth

Downstream Conditions woods; road

Summary of File Data letter 3/11/66 from McKenzie states that "it is not considered that any hazard is involved". Letter sent to owner

Remarks East dam has been overtopped at 5' height causing some erosion of crest and downstream face

Would Failure Cause Damage? Possible Class B



September 26, 1966

Mr. Milton Livingston, Secretary
The Lake Waubeeka Property Owners, Inc.
Danbury, Connecticut

Dear Mr. Livingston:

The Lake Waubeeka dikes were inspected on September 20, 1966 by a consulting engineer retained by this Commission. The inspection was made in the company of your Superintendent, Mr. Peter Couchevich.

The dikes were found to be in good repair as a result of maintenance performed during the past few months. Our engineer recommended that rip-rap be placed on the water side of the east dike to provide proper protection against wave action. When this is accomplished, the recommendations in our letter dated August 8, 1966 will be completed. Thank you for your cooperation.

Very truly yours,

William P. Sander
Engineer - Geologist

WPS:js

A. M. MCKENZIE
CIVIL ENGINEER
M. AM. Soc. C. E.

HYDRAULICS
WATER SUPPLY
LAND DEVELOPMENT

1300 MAIN STREET
SOUTH MERIDEN, CONN.

September 21, 1966.

Water Resources Commission,
State of Connecticut,
State Office Building,
Hartford, 15,
Connecticut.

STATE WATER RESOU COMMISSION RECEIVED SEP 21 1966 ANSWERED REFERRED FILED

Ref: Waubeeka Lake,
Town of Danbury.

Gentlemen:

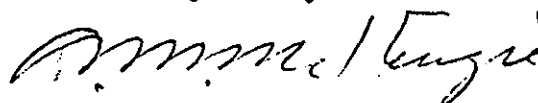
As requested in your letter of September 8, I visited the Waubeeka Lake Development again yesterday and, with Mr. Couchevich, looked over the repairs which have recently been made to the dikes.

On the west side of the Lake a "sort" of headwall has been built at the intake end of the 36"Ø concrete pipe which is the only outlet for water from the Lake. This is referred to at the end of the 3rd. paragraph of my letter of March 11. The headwall extends up to the top of the pipe only and is not very well done, but, in this location it will serve to keep the pipe from being pushed out of place. Slots have been left in the concrete so that boards can be dropped in to form a gate over the face of the pipe. However, the present freeboard on the dikes is only about 2'-6" and I cautioned Mr. Couchevich against raising the water surface more than 6" to 8" above it's present level.

On the east side of the Lake there was a break in the dike which is clearly shown in photo #10. This area has been filled in with rock and earth which appears to have been well compacted and the surface is at the same elevation as the rest of the dike. The Superintendent agreed to put some rip-rap on the water side of the new fill to provide proper protection against wave action.

When the rip-rap is placed the repairs suggested in the last paragraph of my letter Of March 12th. will have been completed. A couple photographs of the recent work will be forwarded as soon as they are processed.

Yours very truly



A. M. McKenzie.

September 8, 1966

Mr. A. M. McKenzie
1300 Main Street
South Meriden, Connecticut

Dear Mr. McKenzie:

Enclosed is a copy of a letter which we received from the Lake Waubeeka Property Owners.

We sent them the recommendations that were contained in your report dated March 11, 1966. In view of comments made by Mr. Livingston, we would like you to reinspect the dam, preferably in the company of Mr. Couchevich, the Superintendent. Upon completion of the inspection, please report again on the condition of the dam.

Very truly yours,

William P. Sander
Engineer - Geologist

WPS:js

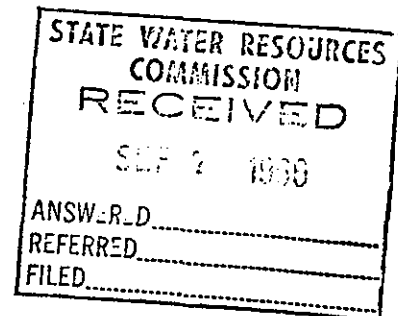
enclosure



THE LAKE WAUBEEKA PROPERTY OWNERS, INC
LAKE WAUBEEKA, DANBURY, CONNECTICUT

September 7, 1966

Mr. William P. Sander
Water Resources Commission
State of Connecticut
State Office Building
Hartford 15, Conn.



Dear Mr. Sander,

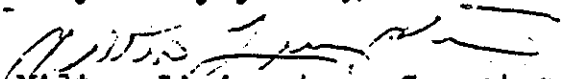
This will acknowledge receipt of your letter of August 8, 1966 about the consultants report after inspecting Lake Waubeeke at Danbury, Connecticut owned by the Lake Waubeeke Property Owners Inc.

Our superintendent, Mr. Peter Couchevith who can be reached at 404 Post Road in our community and whose phone number is 743-9119, is in the process of constructing the head wall at the intake end of the 36 inch pipe on the beach now that the heavy Summer use of the beach is ebbing.

We are puzzled however about your recommendations about the break in the dike at the East end of the Lake which indicates that rock had apparently recently been placed there. The fact is that we placed the rock there during the first stage of our contemplated repair of the dike but early in July of this year we completely covered the rock and built up the entire section to a level of approximately two feet above the water level. Is it possible that your inspection was made prior to this even though your letter is dated August 8th. It would be most helpful if you can check to determine when the inspection was made. If there is still work to be done on the dike our superintendent asks that your office tell him exactly what he is to do since we even had a contractor go over the ground with him this past week and they both feel that any further attempt to raise the level along the entire dike would kill the trees and probably cause erosion where it has not taken place.

We are most happy to hear that your report indicates no immediate hazards and please be assured that we are prepared to cooperate with your office in every possible way and as quickly as possible.

Very truly yours,


Milton Livingston, Secretary

August 8, 1966

Mr. Milton Livingston, Secretary
Lake Waubeeka Property Owners, Inc.
Danbury, Connecticut

Dear Mr. Livingston:

In the process of inventoring all the dams in the State, the dams and dikes on Waubeeka Lake in Danbury have recently been inspected by an engineering firm acting as a consultant to this office.

According to the Danbury assessors office, the dams and dikes on Waubeeka Lake, Danbury, are owned by the Lake Waubeeka Property Owners, Inc.

Whereas no immediate hazards were noted, there are a few points which should receive attention. The State Water Resources Commission, as further explained in the enclosed copy of the pertinent State statutes, has jurisdiction over all such structures "which by breaking away or otherwise, might endanger life or property."

In the consultant's report, it was recommended that a head-wall be constructed at the intake end of the thirty six inch pipe on the beach, which pipe runs under the roadway on the dike or dam on the west side of the lake. The break in the dike on the east side of the lake (where loose rock has apparently recently been placed) should be repaired with properly compacted earth fill and, "where required, raised so that there will be a freeboard of at least two feet for its entire length. Also, some stone rip-rap should be placed along the water side of the dike to prevent any erosion in case of even slight wave action."

In light of this report, it is evident that this work should be done to reduce possible future hazards. May we hear from you soon in this regard?

Very truly yours,

William P. Sander
Engineer - Geologist

WPS:WO:s

enclosure



WJH

THE LAKE WAUBEKA PROPERTY OWNERS, INC.
DANBURY, CONNECTICUT

August 1, 1966

Mr. William H. O'Brien III
State of Connecticut Water Resources Commission
State Office Building
Hartford 15, Conn.

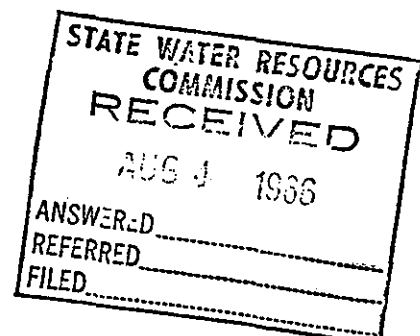
Dear Sir,

Your letter of July 25 addressed to the Lake Waubeeka Property Owners Inc. at 1 Ezra Street, Danbury, Conn. puzzles us since you are obviously communicating with some other community and not the Lake Waubeeka Property Owners Inc. since we know nothing of a letter dated March 29, 1966 to us nor a reply you received from Mr. H. Roomer of Trumbull stating that Mr. Shhefkind had been ill and would look into the matter.

The Danbury phone book does list a Morris Schefkind at 1 Ezra Street, Danbury so we suggest you write to him and see what you can find out from him. Our address is Lake Waubeeka, Danbury, Conn. and we know nothing about the two gentlemen you mention.

Yours very truly,

Milton Livingston
Milton Livingston, Secretary



July 25, 1966

Lake Waubeeka Property Owners, Inc.
1 Ezra Street
Danbury, Connecticut

Gentlemen:

On March 29, 1966 we wrote to you listing certain items which should receive attention on the dams and dikes on Waubeeka Lake in Danbury. On May 24, 1966 we received a letter from a Mr. H. Rooner, 108 Chestnut Hill Road, Trumbull, stating that Mr. Scheffkind had been ill but would look into the matter when he was able.

I hope that Mr. Scheffkind's health has improved. We would like to hear from someone in your association regarding what action you intend to take regarding the suggestions in our letter of March 29, 1966.

Very truly yours,

William H. O'Brien, III
Civil Engineer

WHO:dj

William H. O'Brien III
State of Connecticut
Water Resources Commission
State Office Building
Storford 15, Conn.
Dear Mr. O'Brien:

May 23, 1956

Mr. Morris Scheffelsund recently had
a heart attack, and this is the reason
for the delay in answering your letter
to him of March 29th in reference
to Lake Waukegan in Danbury.

Please be assured that when he
is able, he will look into the matter,
and the suggestions you have outlined
to him.

Very truly yours
H. Roover

Chestnut Hill Rd.
Trumbull Conn.

STATE WATER RESOURCES COMMISSION RECEIVED MAY 24 1956 ANSW. R.D. _____ REFERRED _____ FILED _____

March 29, 1966

Lake Waubeeka Property Owners, Inc.
c/o Morris Scheffkind
1 Ezra Street
Danbury, Connecticut

Gentlemen:

In the process of inventoring all of the dams in the State, the dams and dikes on Waubeeka Lake in Danbury have recently been inspected by an engineering firm acting as a consultant to this office.

Whereas no immediate hazards were noted, there are a few points which should receive attention. The State Water Resources Commission, as further explained in the enclosed copy of the pertinent State statutes, has jurisdiction over all such structures "which, by breaking away or otherwise, might endanger life or property".

In the consultant's report, it was recommended that a head-wall be constructed at the intake end of the thirty-six inch pipe on the beach, which pipe runs under the roadway on the dike or dam on the west side of the lake. The break in the dike on the east side of the lake (where loose rock fill has apparently recently been placed) should be repaired with properly compacted earth fill and, "where required, raised so that there will be a freeboard of at least two feet for its entire length. Also, some stone rip-rap should be placed along the water side of the dike to prevent any erosion in case of even slight wave action".

In light of this report, it is evident that this work should be done to reduce possible future hazards. May we hear from you soon in this regard?

Very truly yours,

William H. O'Brien, III
Civil Engineer

WHO:js

A. M. MCKENZIE

CIVIL ENGINEER

M. Am. Soc. C. E.

HYDRAULICS
WATER SUPPLY
LAND DEVELOPMENT

1300 MAIN STREET
SOUTH MERIDEN, CO

March 11, 1966.

Water Resources Commission,
State of Connecticut,
State Office Building,
Hartford, 15,
Connecticut.

STATE WATER RESC
COMMISSION
RECEIVE

MAR 21 1966

ANSWERED.....
REFERRED.....
FILED.....

Ref: Waubeeka Lake Dam,
Town of Danbury,
Bethel Quad.

Gentlemen:

As instructed in your letter of February 21
I have inspected the Waubeeka Lake Dam and submit the follow-
ing report for your information.

Waubeeka Lake is a real estate development
with a large number of houses, mostly for summer occupancy, and,
according to the sign at the entrance, is privately owned and
controlled. It is used for recreational purposes only.

The Lake fills a depression in the hills and
appears to be almost entirely spring fed as the water shed drain-
ing into it is very small - about 145 acres. There are three places
around the Lake where low points have been filled in to raise the
water to it's present level. The principal "dam", or dike, is on
the west side of the Lake at about the center. It is an earth
fill with an overall length of about 140', a maximum height of 18'
and carries on it one of the roads running thru the development.
The fill is approximately 30' wide on top, with an oiled surface
forming the road and the area between the edge of the road and
the Lake has been filled in with clean sand to form a beach. See
photos #6 & #9. The center of the road is 2' to 2'-6" above the
water surface. Running under the beach and the road is a 36"Ø
concrete pipe which is the only real drain from the Lake. There is no
headwall at the intake nor is there any gate on the line; on this
date about 10" of water was flowing into the pipe. The water is
very clear and there is no indication of much variation in the
elevation of the shore line which further indicates that the lake
is spring fed.

On the east side of the Lake, also at about the
center point, there is another low dike about 150' long with a maximum
height of six feet. This dike is 8' to 12' wide on top and the face
away from the Lake is supported by a dry stone wall. See photo .
The freeboard here is from 0 to 18". At one point in the dike
there has been some erosion and a small stream has recently flow-
ed thru the opening. Some loose rock fill has been thrown into
the opening within a few days and there is still a trickle of
water running thru. The edge of the road along the east side of
the Lake is not more than 15' to 20' from the dike and a double
catchbasin has been installed on the Lake side of the road

Page - 2 -

which takes the runoff and carries it under the road thru a pipe. See photos #// . From the appearance of the area this overflow has been going on for a number of years without producing any serious break in the dike. Judging from the size of the trees growing on the dike it has been in place 25 - 30 years, or more.

At the south-east corner of the Lake, where the road makes a sharp, rightangle bend, there is another spot where a low point has been filled in and a house built on a part of the fill. The filled area is nearly a hundred feet wide with an elevation of perhaps 18" above the water surface and there is a slight trickle coming thru. However, I do not consider this spot of any importance.

The Lake covers some 40 acres and the area draining into it is about 145 acres. The drainage area is fairly steep, heavily wooded with many irregular low spots and considerable rock exposed on the surface. There are probably more than a hundred houses in the development. Using a standard formula for calculating a 100 year flood the figures are as follows:

$$Q = R \times C \times A \times S \text{ where } R = 3.7, C = .55 \text{ and}$$

$$S = 40$$

$$\text{then } Q = 3.7 \times .55 \times .25 \times 40$$

$$= 20 \text{ c.f.s.}$$

The 36"Ø drain has a capacity of about 31c.f.s. which is ample. The earth fill forming the dam is in good condition and shows no signs of erosion. It is my opinion that the Lake is principally spring fed and that there is very little variation in the water level from season to season and from year to year. There does not appear to be any reason for failure of the dam and it is not considered that any hazard is involved. The overflow from the Lake discharges into the Saugatuck River about 3/4 of a mile to the west. The flow from the break in the dike on the east side goes into a large swamp about a mile to the east and then into Redding Brook. This flow will cease when the dike is repaired.

A. M. MCKENZIE

CIVIL ENGINEER

M. AM. SOC. C. E.

HYDRAULICS
WATER SUPPLY
LAND DEVELOPMENT

1300 MAIN STREET
SOUTH MERIDEN, CON

Page - 3 -

It is recommended that a head wall be constructed at the intake end of the 36" ϕ pipe culvert on the west side. On the east side the break in the dike should be repaired with properly compacted earth fill and, where required, raised so that there will be a freeboard of at least 2' for it's entire length. Also, some stone rip-rap should be placed along the water side of the dike to prevent any erosion in case of even slight wave action.

Yours very truly



A. M. McKenzie

Enclosure - 5 Photographs.

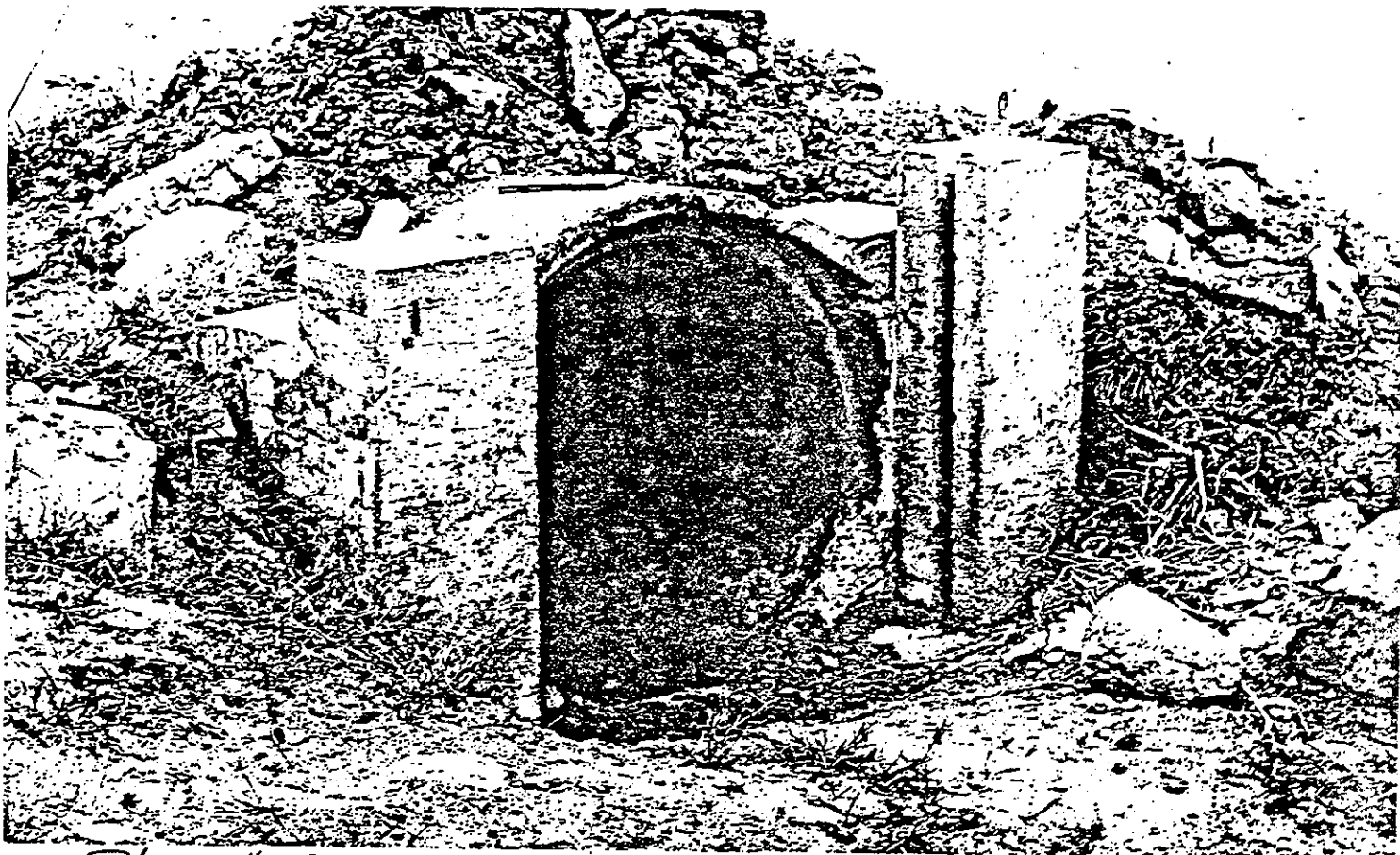


Photo #12



Photo #13

Waubeek Lake
Town of Danbury
9/20/66

This is close-up of headwall recently constructed at inlet end of 36" ϕ drain from Lake. See photo #6, made 3/10/66, for original condition here..

In letter of 9/21/66, on this project, I cautioned against placing "stop-logs" in the slots shown in this photo.

Waubeek Lake
Town of Danbury
9/20/66

This photo shows recent repairs to dike on E. side of Lake -- in previous condition here see photo #10 made 3/10/66. This shot is looking along dike in opposite direction from photo #10.

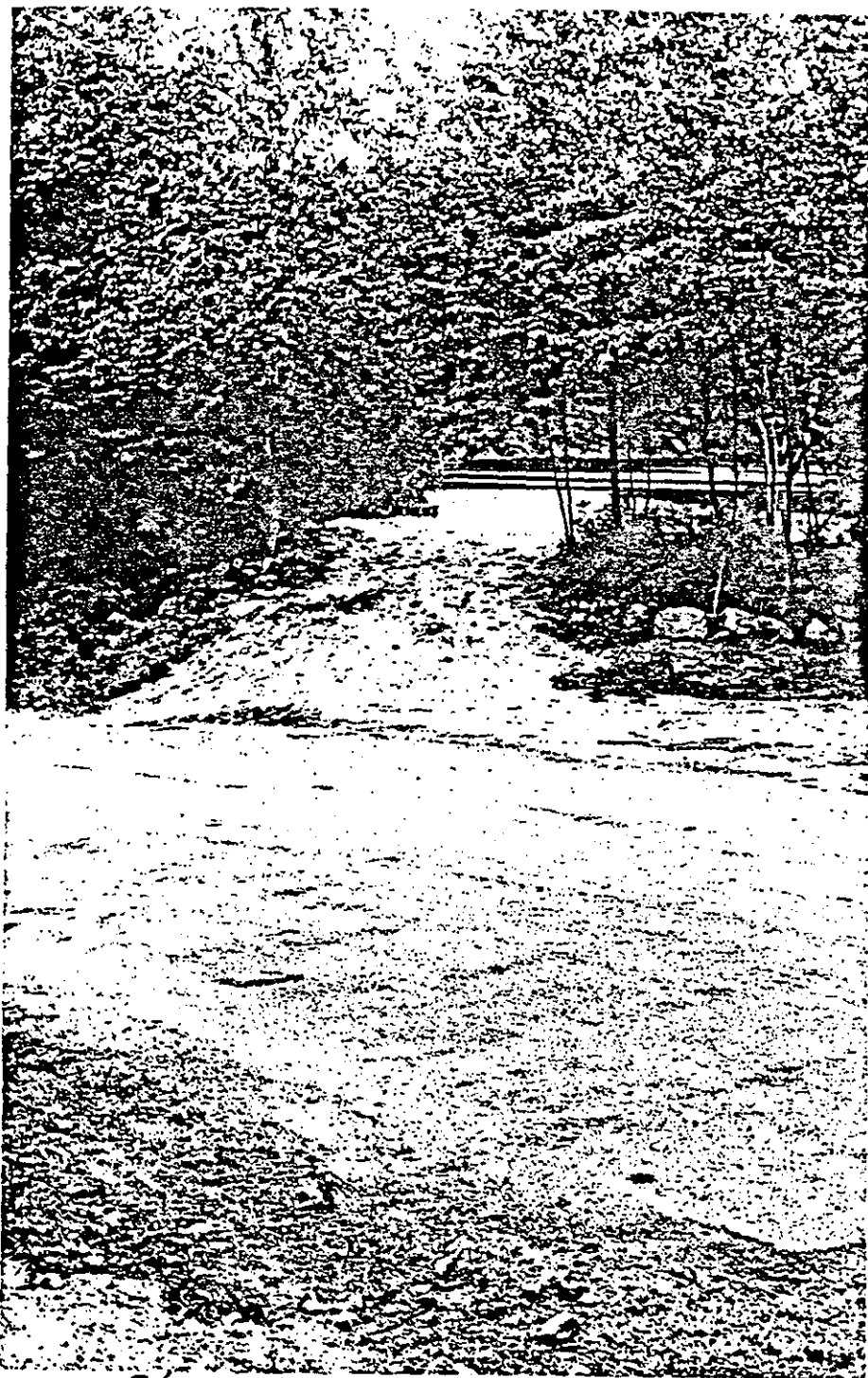
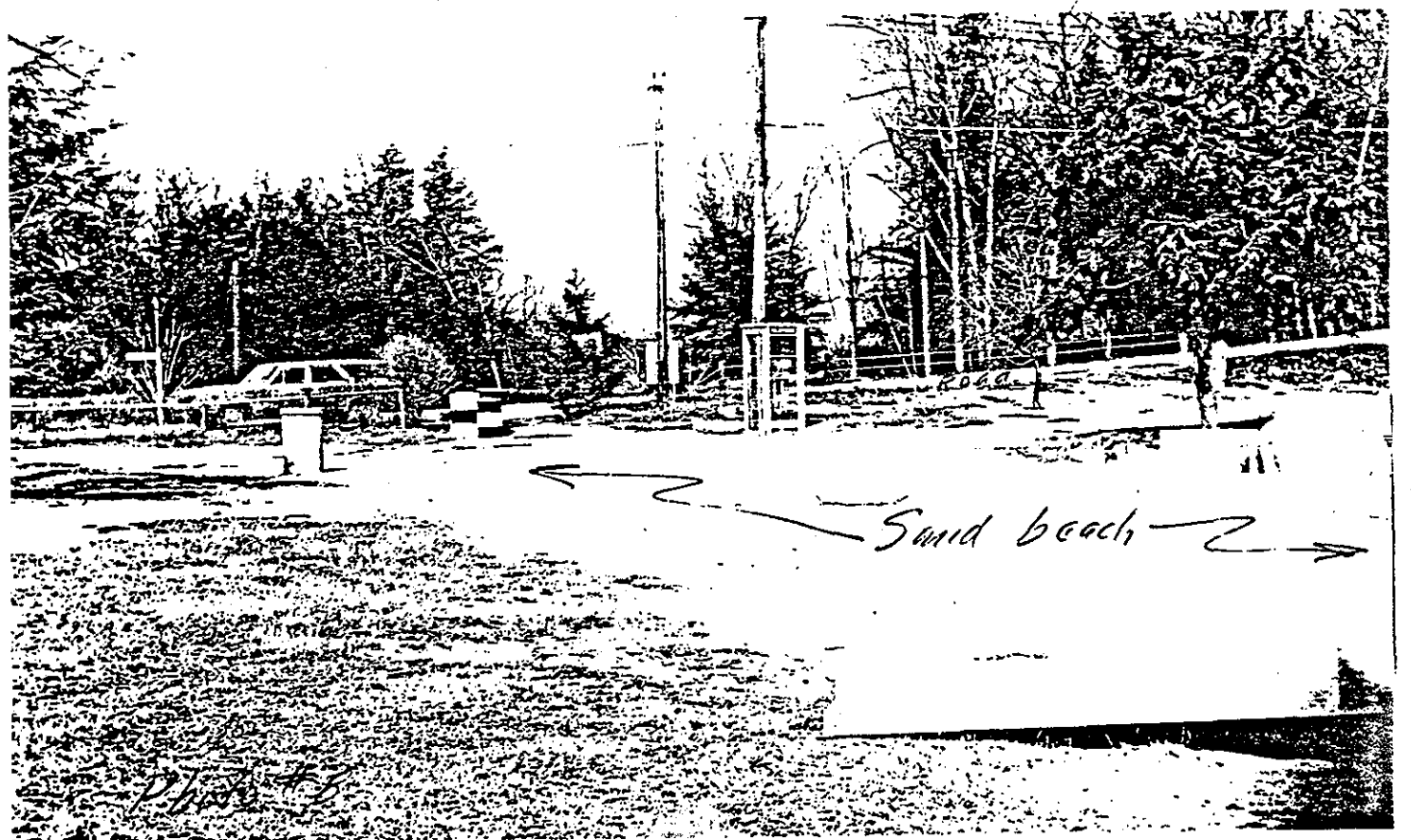


Photo #14

17

—



Waubesa Lake
Danbury.

3/10/66

Looking \pm S.E. over road and beach

9
11
12

Waubesa Lake
Danbury.

3/10/66

f. 11
(10)

Looking \pm N.W. over part of back.
Road in background. Photo #6 shows
area to right of this photo.



Photo #6



Photo #11

3/10/66

F
1

Waubeeka Lake,
Danbury.

Main "DAM", or dike - locking \pm N. over
beach and road. The intake end of
36" conc. pipe in right center of photo

3/10/66

Waubeeka Lake
Danbury.

Dike of E. side of Lake. Stone wall,
visible above snow, supports earth fill.
Road in foreground.

G $\frac{D}{2}$



Photo #10

3/10/66
Waubesa Lake
Danbury.

Break in dike on E. shore
of Lake - note loose stone
thrown into break.

This view looking \pm N. over dike.

A
+ 16
- 16
X

February 21, 1966

Mr. A. M. McKenzie
1300 Main Street
South Meriden, Connecticut

Dear Mr. McKenzie:

Under your contract as consultant to this Commission, will you please inspect and report on the Waubeeka Lake Dam in Danbury. This dam is located on the Bethel Quadrangle about a half mile east of Route 7.

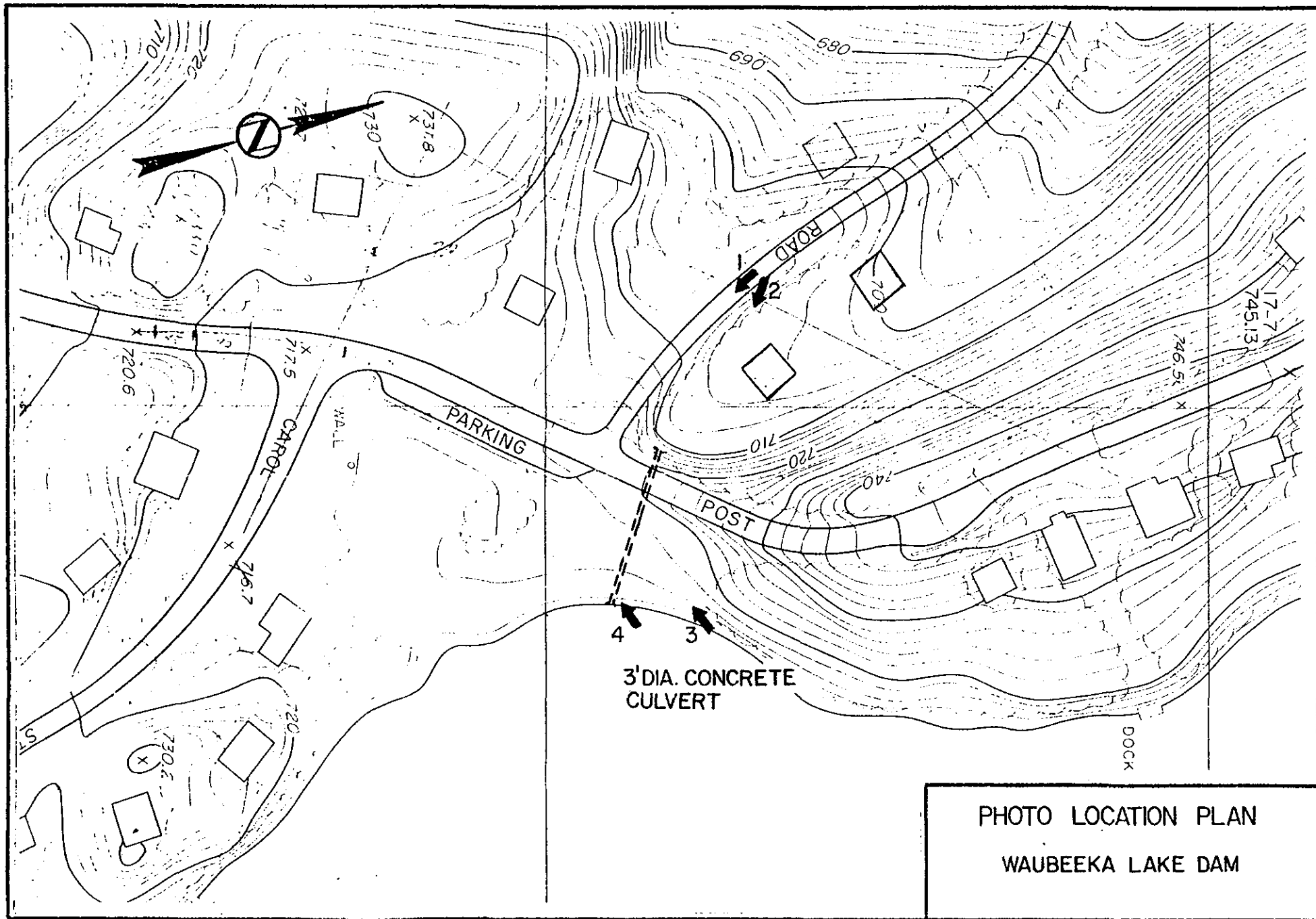
Very truly yours,

William P. Sander
Engineer - Geologist

WPS:js

APPENDIX C

PHOTOGRAPHS



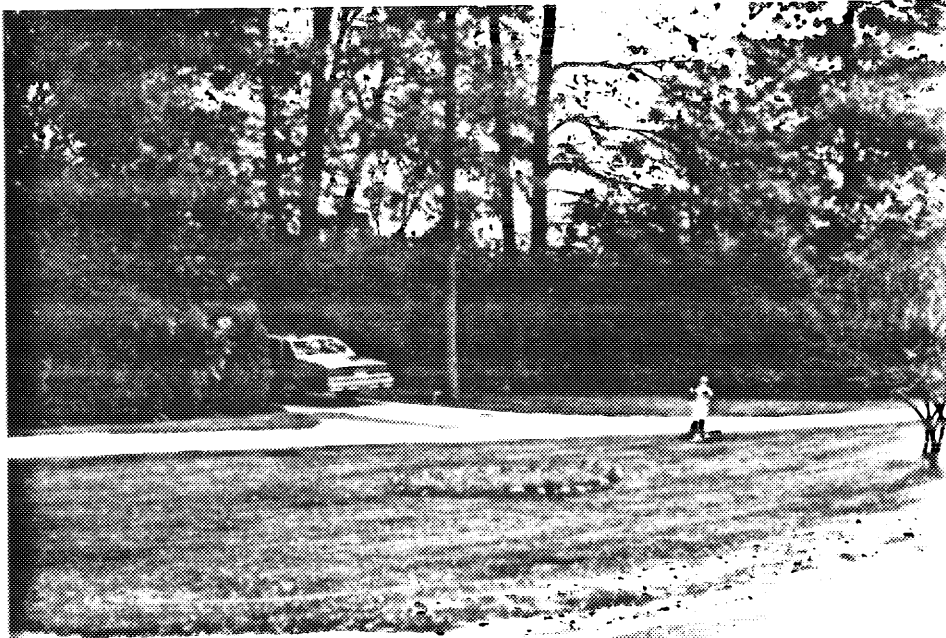


Photo 1 Downstream face and right abutment of dam on west side of Waubeeka Lake. First floor of home in impact area is defined by the deck, left.

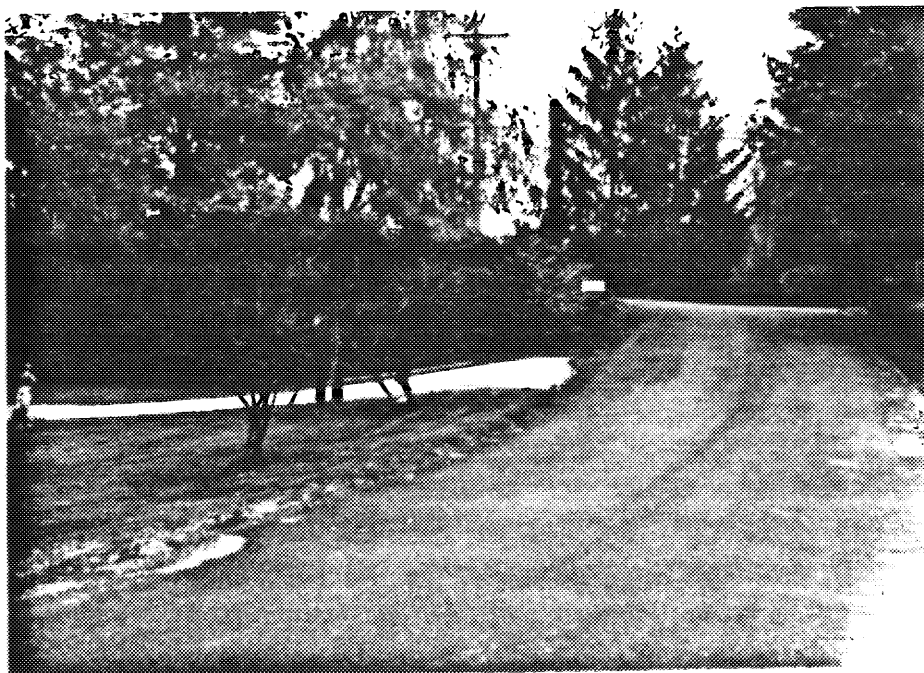


Photo 2 Downstream face of dam and Alan Road. (West Dike).

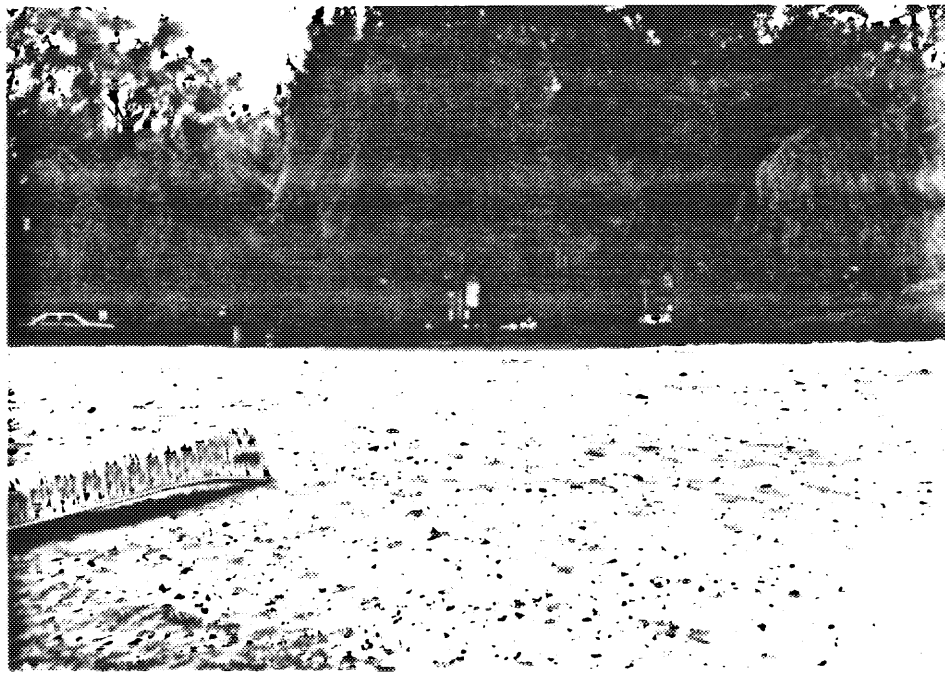


Photo 3 Upstream face of dam - Waubeeka Lake Beach (West Dike).

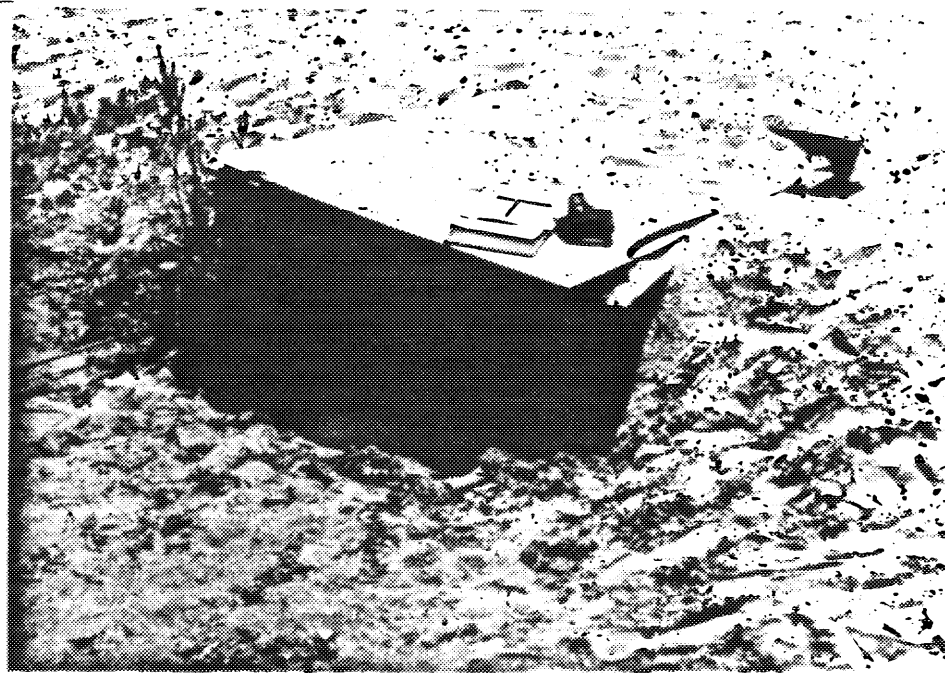


Photo 4 Intake of 3-foot diameter concrete conduit at dam (West Dike).

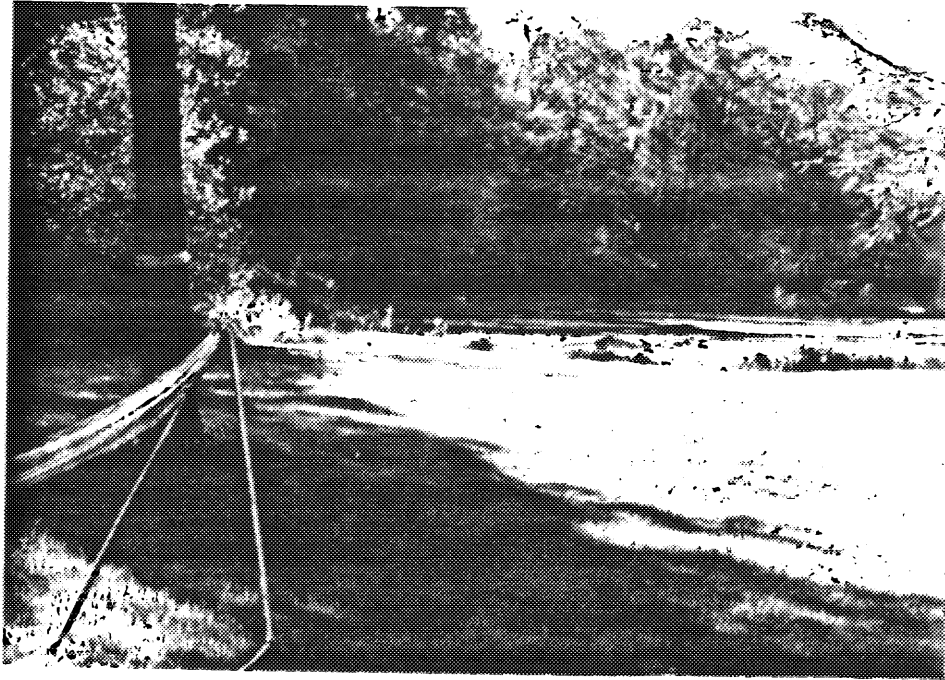


Photo 5 Landfill at southern end of lake.

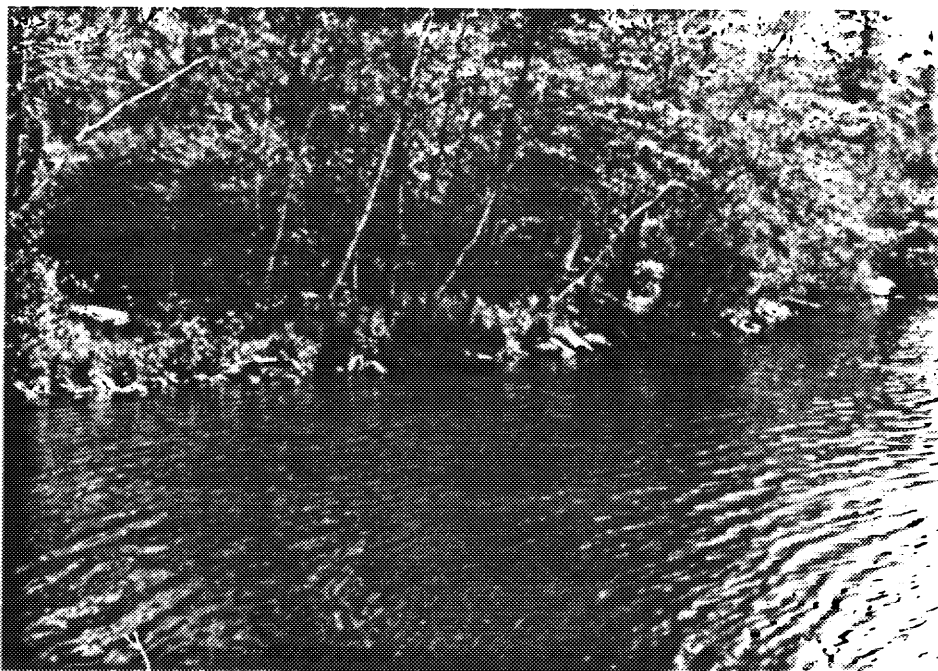


Photo 6 Upstream face of East Dike.



Photo 7 Downstream face of East Dike

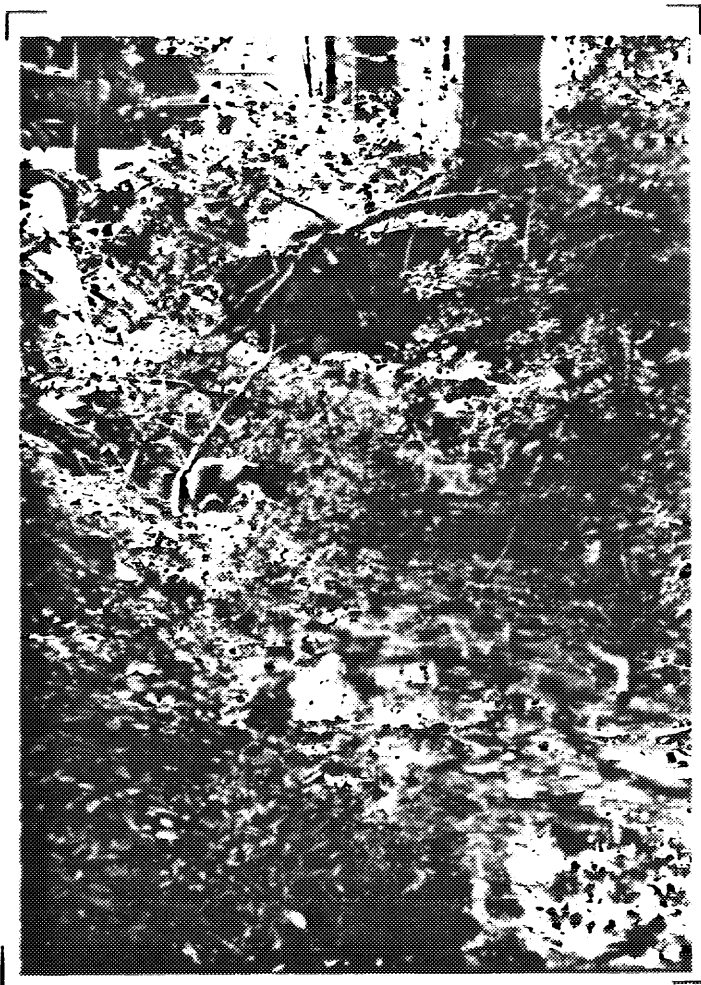


Photo 8 Discharge stream from
storm drain located on road
downstream of East Dike.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



INTERNATIONAL ENGINEERING COMPANY, INC.

Project NATIONAL DAM INSPECTION PROGRAM
Feature WAUBEKA LAKE DAM
Item _____

Contract No. 2616-025Designed 5

Checked _____

Sheet 2 of 22

File No. _____

Date 7-21-81

Date _____

HYDROLOGIC/HYDRAULIC INSPECTION

WAUBEKA LAKE DAM, CT00065, DANBURY, CONNECTICUT

DRAINAGE AREA AND SITE DESCRIPTION

THE DRAINAGE AREA IS 0.238 SQUARE MILES, AND WAS PLANIMETERED FROM THE $7\frac{1}{2}'$ USGS QUADRANGLE, BETHEL, CT. . THE LAKE IS FED PRIMARILY BY AN ARTESIAN SPRING. THE IMPOUNDMENT IS SECURED BY THREE DIKES OF VARYING FREEBOARDS. A THREE-FOOT DIAMETER RCP CULVERT DRAINS EXCESS WATER BUILD-UP IN THE LAKE. HOWEVER THE INVERT OF THE INLET IS ONLY 1.5 FEET BELOW THE TOP OF ANOTHER DIKE SITUATED ON THE EASTERN SHORE OF THE LAKE. WEIR FLOW OCCURS OVER THE EASTERN DIKE BEFORE PRESSURE FLOW BEGINS IN THE 3' CULVERT SPILLWAY. WITH 1.5 FEET OF HEAD ON THE CROWN OF THE CULVERT, WEIR FLOW BEGINS OVER THE THIRD, OR SOUTHERN DIKE. WEIR FLOW WILL NOT OCCUR OVER THE DIKE SUPPORTING THE SPILLWAY (WESTERN DIKE) UNTIL THE CROWN IS SUBMERGED BY APPROXIMATELY 5 FEET OF WATER.

HOUSES ARE SITUATED BELOW THE WEST AND SOUTH DIKES. AT PRESENT





INTERNATIONAL ENGINEERING COMPANY, INC.

Project

NATIONAL DAM INSPECTION PROGRAM

Contract No.

2616-025

Sheet

3 of 22

Feature

WABEKA LAKE DAM

Designed

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File No.

Date

7-22-81

Item

Checked

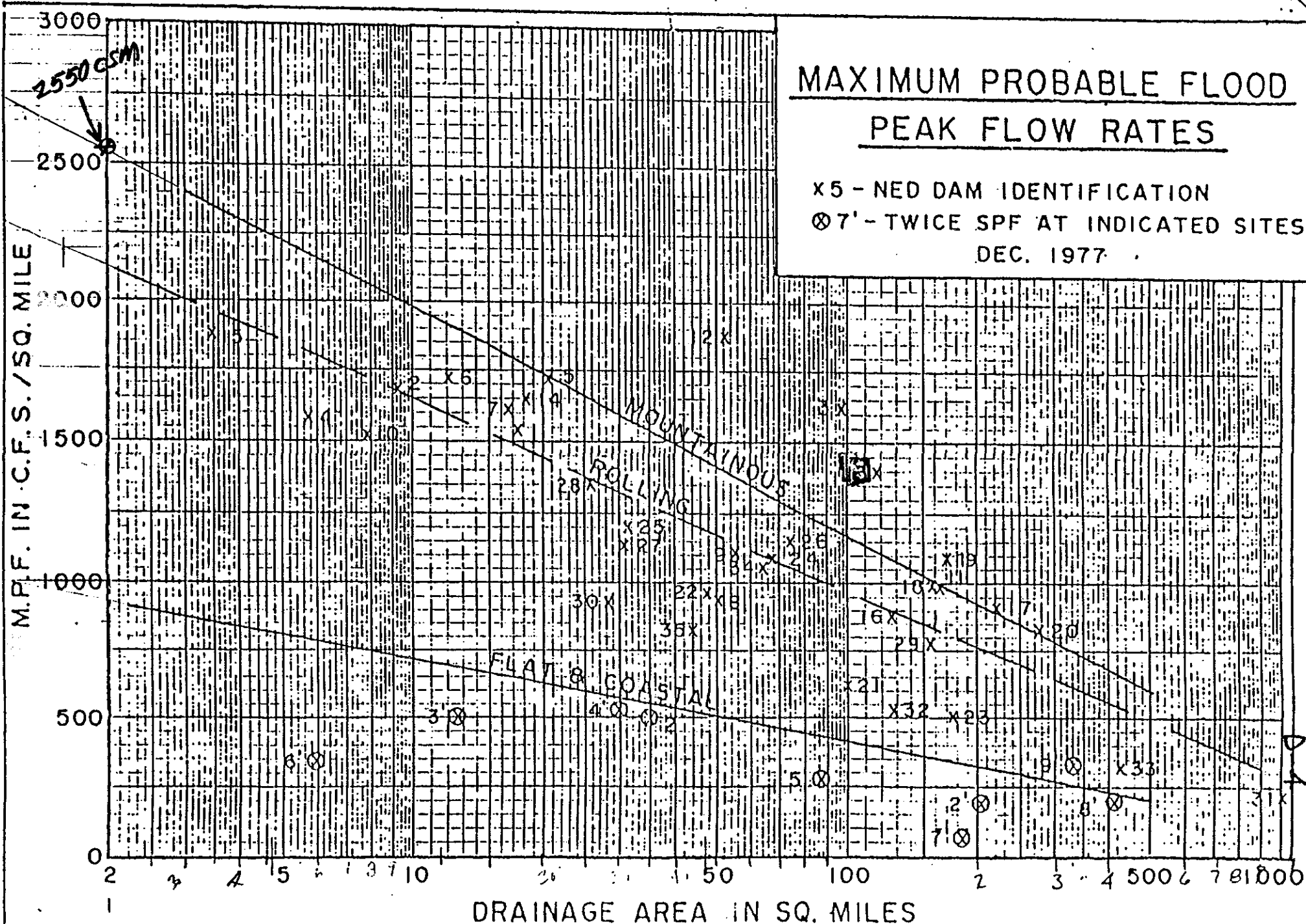
Date

NO POTENTIAL HAZARD APPEARS TO EXIST BELOW THE EAST DIKE WHICH, BEING THE LOWEST, IS EFFECTIVELY AN EMERGENCY SPILLWAY. FAILURE OF THE SOUTH DIKE IS IMPROBABLE IN THAT IT IS APPARENTLY A LAND FILL DEPOSITED IN A SADDLE BETWEEN HILLS SKIRTING THE SOUTHERN PERIMETER OF THE LAKE. THE WIDTH OF THE SOUTH DIKE IS OVER 100 FEET, WHILE THE HEIGHT IS ONLY TWO TO THREE FEET. THE LOWEST POINT OF THE SOUTH DIKE IS EL. 716; THIS ELEVATION WILL NEVER BE REACHED BY THE PMF EVEN IF THE 3 FOOT CULVERT IS PLUGGED, SINCE THE EAST DIKE WILL PASS THE ENTIRE PMF.

THE RESERVOIR SURFACE AREA IS 34.6 AC* AT EL 712 NGVD. AS SUCH IT COMPRISES 23% OF THE TOTAL DRAINAGE AREA

* PLANIMETERED ON G.S. BETHEL QUAD, 7 1/2' SERIES.







Project

NATIONAL DAM INSPECTION PROGRAM

Contract No.

2616-025

Sheet

5 of 22

Feature

WANBEKA LAKE DAM

Designed

J

File No.

Date

7-24-81

Item

Checked

Date

1) PERFORMANCE AT PEAK FLOOD CONDITIONS

a) WATERSHED CLASSIFIED AS MOUNTAINOUS

b) WATERSHED AREA:

LAKE .055 mi²OVERLAND .183 mi²
.238 mi²

c) PEAK FLOODS (FROM NED-ACE GUIDELINES; GUIDE CURVES FOR PMF)

BECAUSE THE WATERSHED AREA IS LESS THAN 2 mi², AS

CSM OF 2550 (CF FOLLOWING MP) WAS SELECTED

$$PMF = 2550(.238) = 607 \text{ cfs}$$

$$\frac{1}{2} PMF = 304 \text{ cfs}$$

2) SURCHARGE AT PEAK INFLOWS (PMF & $\frac{1}{2}$ PMF)

a) OUTFLOW RATING CURVE

1) SPILLWAY

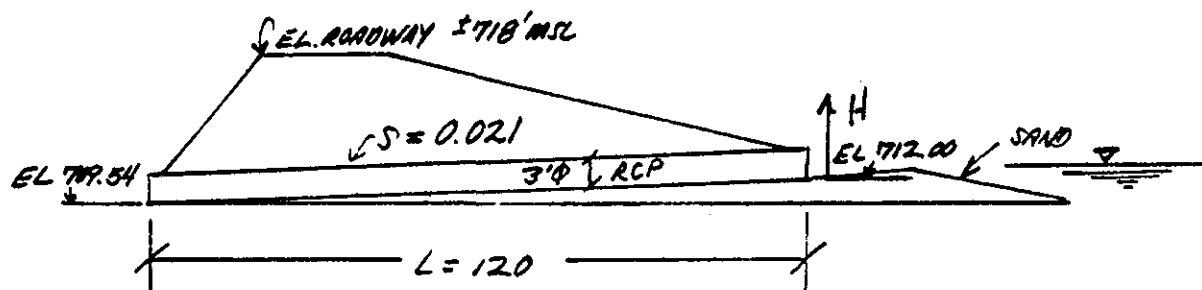
THE SPILLWAY IS A 3'Ø RCP PIPE ON A

SLOPE OF 0.021. ITS INVERT IS AT EL 712 MSL.



Project
Feature
ItemNATIONAL DAM INSPECTION PROGRAM
WAUBESA LAKE DAMContract No. 2516-025
Designed 3
Checked
Sheet 6 of 22
File No.
Date 7-24-81
Date

THE DAM CONSISTS OF A ROAD EMBANKMENT BUILT ALONG A NATURAL SADDLE WHICH LIES BETWEEN HILLS FORMING A RIDGE ALONG THE WESTERN AND SOUTH WESTERN FRANGES OF THE LAKE. A SECTION THROUGH THE ROAD EMBANKMENT AND $\frac{1}{2}$ OF CULVERT IS SHOWN BELOW.



A PLAN VIEW OF THE SYSTEM IS SHOWN ON PAGE D-21.

A RATING CURVE FOR THE CULVERT IN TERMS OF AN FHA CULVERT NOMOGRAPH IS INCLUDED, PAGE D-7. A PROFILE THROUGH THE EAST DIKE APPEARS ON SHEET D-8. BECAUSE WATER WAS NOT EXPECTED TO RISE TO THE ROADWAY (IN THE ABOVE SKETCH) A PROFILE WAS NOT NECESSARY.

THE PROCEDURE USED IN DEVELOPING THE TOTAL RATING CURVE FOR THE CULVERT, EAST DIKE SYSTEM WAS TO SUM THE TWO RATINGS, PAGE D-11, A_n^{UP} TOGETHER WITH THE STAGE-





Project

NATIONAL DAM INSPECTION PROGRAM

Feature

NAUBEEKA LAKE DAM

Item

Contract No.

2616-025

Sheet

7 of 22

File No.

Designed

B

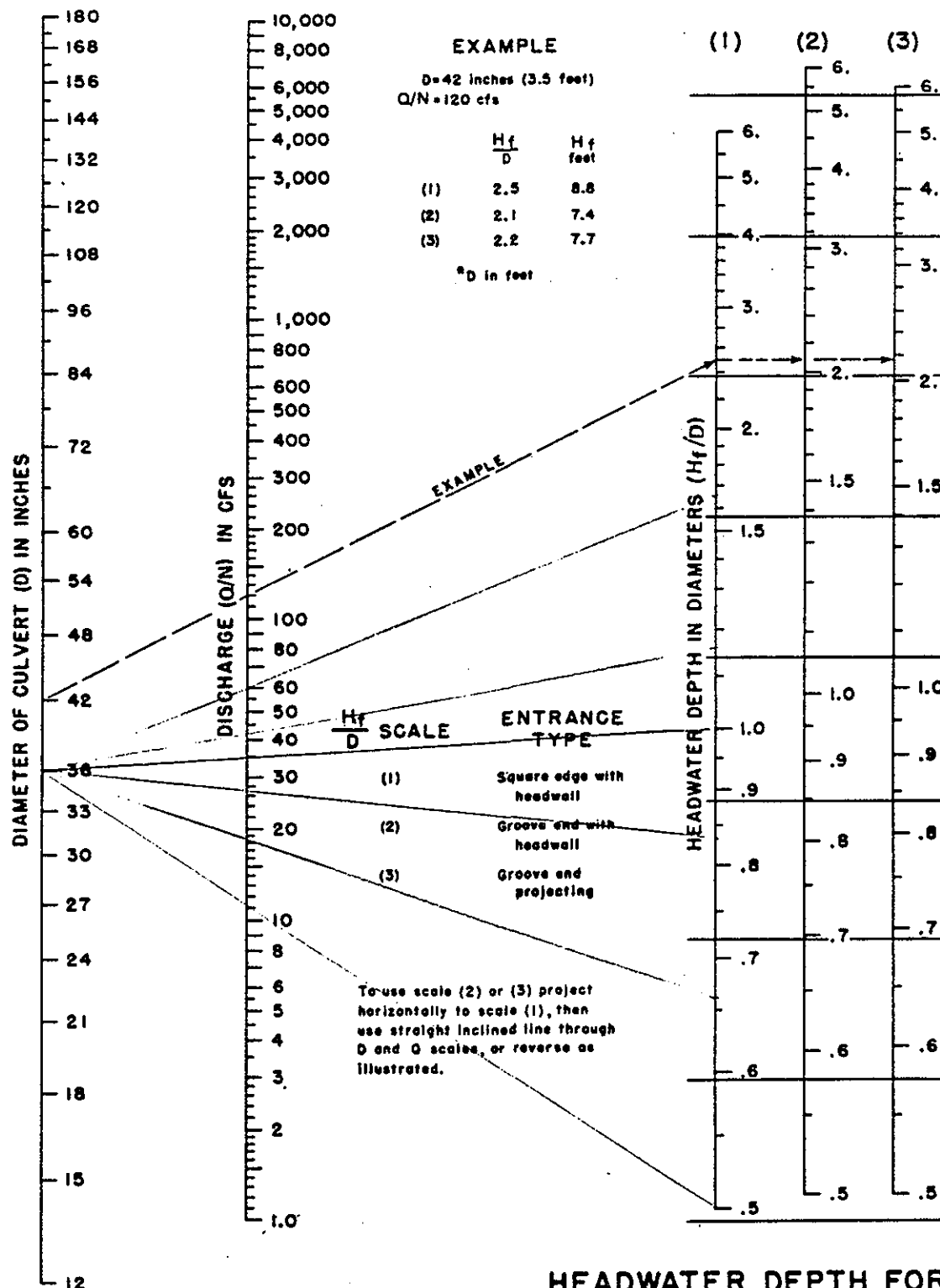
Date

7-22-81

Checked

Date

Chart 11



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL





INTERNATIONAL ENGINEERING COMPANY, INC.

Project

NATIONAL DAM INSPECTION PROGRAM

Contract No.

2616-025

Sheet

8 of 22

Feature

WAUBEEKA LAKE DAM

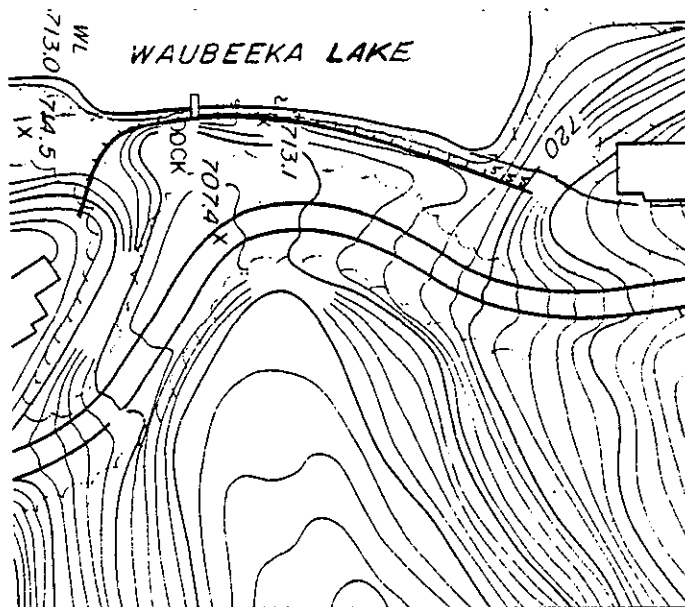
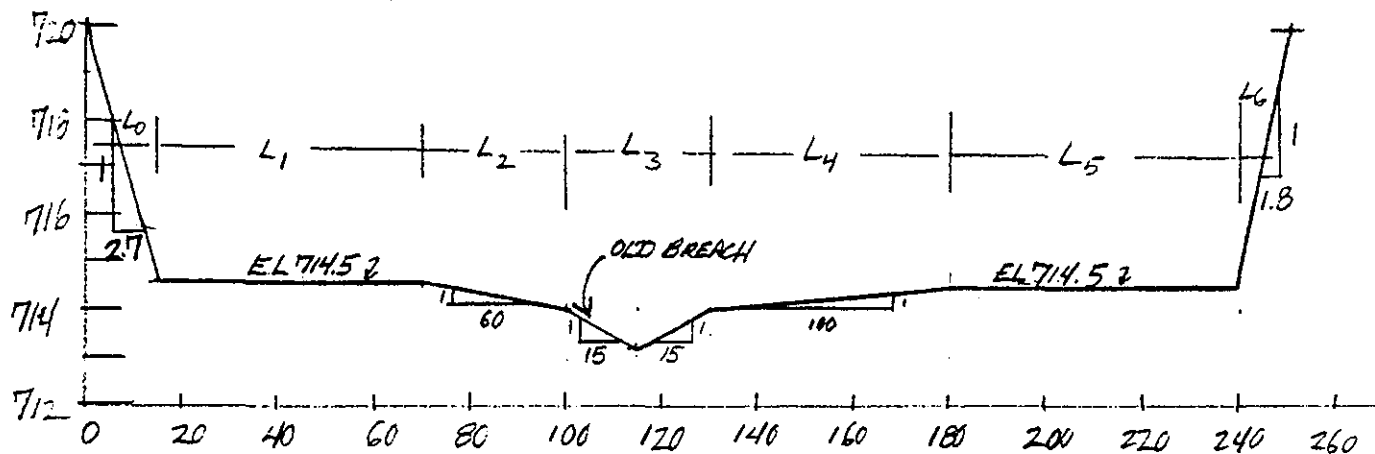
Designed

Date

Item

Checked

Date



PROFILE ALONG ϕ OF EAST DIKE ESTABLISHED FROM DANBURY TOWN
TOPOGRAPHY, $1"=100'$, AND FIELD SURVEY MEASUREMENTS.

DISCHARGE CURVE FOR EAST DIKE: (ZERO FLOW AT EL 712, INVERT OF
3' ϕ RCP UNDER WEST DIKE).





Project

NATIONAL DAM INSPECTION PROGRAM

Contract No. 2616-025

Sheet

9 of 22

Feature

HAMBURG LAKE DAM

Designed

B

File No.

Date 7-22-81

Item

Checked

Date

SEGMENT: DISCHARGE OVER EAST DIKE.

$$L_0 : Q_{L_0} = 2.3 \left(\frac{2}{5} \right) (2.7) (H-2.5)^{\frac{5}{2}} = 2.48 (H-2.5)^{\frac{5}{2}} \quad H \geq 2.5$$

$$L_1 : Q_{L_1} = 2.3 (55) (H-2.5)^{\frac{3}{2}} = 12.7 (H-2.5)^{\frac{3}{2}} \quad H \geq 2.5$$

$$L_2 : Q_{L_2} = 2.3 \left(\frac{2}{5} \right) (60) (H-2)^{\frac{5}{2}}, \quad H \leq 2.5$$

$$Q_{L_2} = 2.3 \left(\frac{2}{5} \right) 60 (H-2)^{\frac{5}{2}} \left[1 - \left(1 - \frac{.5}{(H-2)} \right)^{\frac{5}{2}} \right], \quad H \geq 2.5$$

$$L_3 : Q_{L_3} = 2.3 \left(\frac{2}{5} \right) (15 \times 2) (H-1.1)^{\frac{5}{2}}, \quad H \leq 2$$

$$Q_{L_3} = 2.3 \left(\frac{2}{5} \right) (30) (H-1.1)^{\frac{5}{2}} \left[1 - \left(1 - \frac{.9}{(H-1.1)} \right)^{\frac{5}{2}} \right], \quad H \geq 2$$

$$L_4 : Q_{L_4} = 2.3 \left(\frac{2}{5} \right) (100) (H-2)^{\frac{5}{2}}, \quad H \leq 2.5$$

$$Q_{L_4} = 2.3 \left(\frac{2}{5} \right) (100) (H-2)^{\frac{5}{2}} \left[1 - \left(1 - \frac{.5}{(H-2)} \right)^{\frac{5}{2}} \right], \quad H \geq 2.5$$

$$L_5 : Q_{L_5} = 2.3 (60) (H-2.5)^{\frac{3}{2}} = 13.8 (H-2.5)^{\frac{3}{2}}, \quad H \geq 2.5$$

$$L_6 : Q_{L_6} = 2.3 \left(\frac{2}{5} \right) 1.8 (H-2.5)^{\frac{5}{2}} = 1.66 (H-2.5)^{\frac{5}{2}}, \quad H \geq 2.5$$





Project

NATIONAL DAM INSPECTION PROGRAM

Feature

NAAMBEKA LAKE DAM

Item

Contract No.

2616-025

Designed

B

Checked

Sheet

10 of 22

File No.

Date

7-22-81

Date

DISCHARGE EAST DIKE

H

DISCHARGE 3' Ø RCP (SEE MONOGRAPH D-

3 (cfs)

1.5

11 (cfs)

 ΣQ
14

21

2

18

39

85

2.5

28

113

325

3

35

360

698

3.5

42

740

1164

4.0

60

1224

DISCHARGE FORMULAS: EAST DIKE

$$1.1 \leq H \leq 2$$

$$Q = 27.6 (H - 1.1)^{\frac{5}{2}}$$

$$2 \leq H \leq 2.5$$

$$Q = 27.6 (H - 1.1)^{\frac{5}{2}} \left[1 - \left(1 - \frac{.9}{(H - 1.1)} \right)^{\frac{5}{2}} \right] + 147.2 (H - 2)^{\frac{5}{2}}$$

$$2.5 < H$$

$$Q = 27.6 (H - 1.1)^{\frac{5}{2}} \left[1 - \left(1 - \frac{.9}{(H - 1.1)} \right)^{\frac{5}{2}} \right] + 147.2 \left[1 - \left(1 - \frac{.5}{(H - 2)} \right)^{\frac{5}{2}} \right] (H - 2)^{\frac{5}{2}} + 265 (H - 2.5)^{\frac{3}{2}} + 4.14 (H - 2.5)^{\frac{5}{2}}$$





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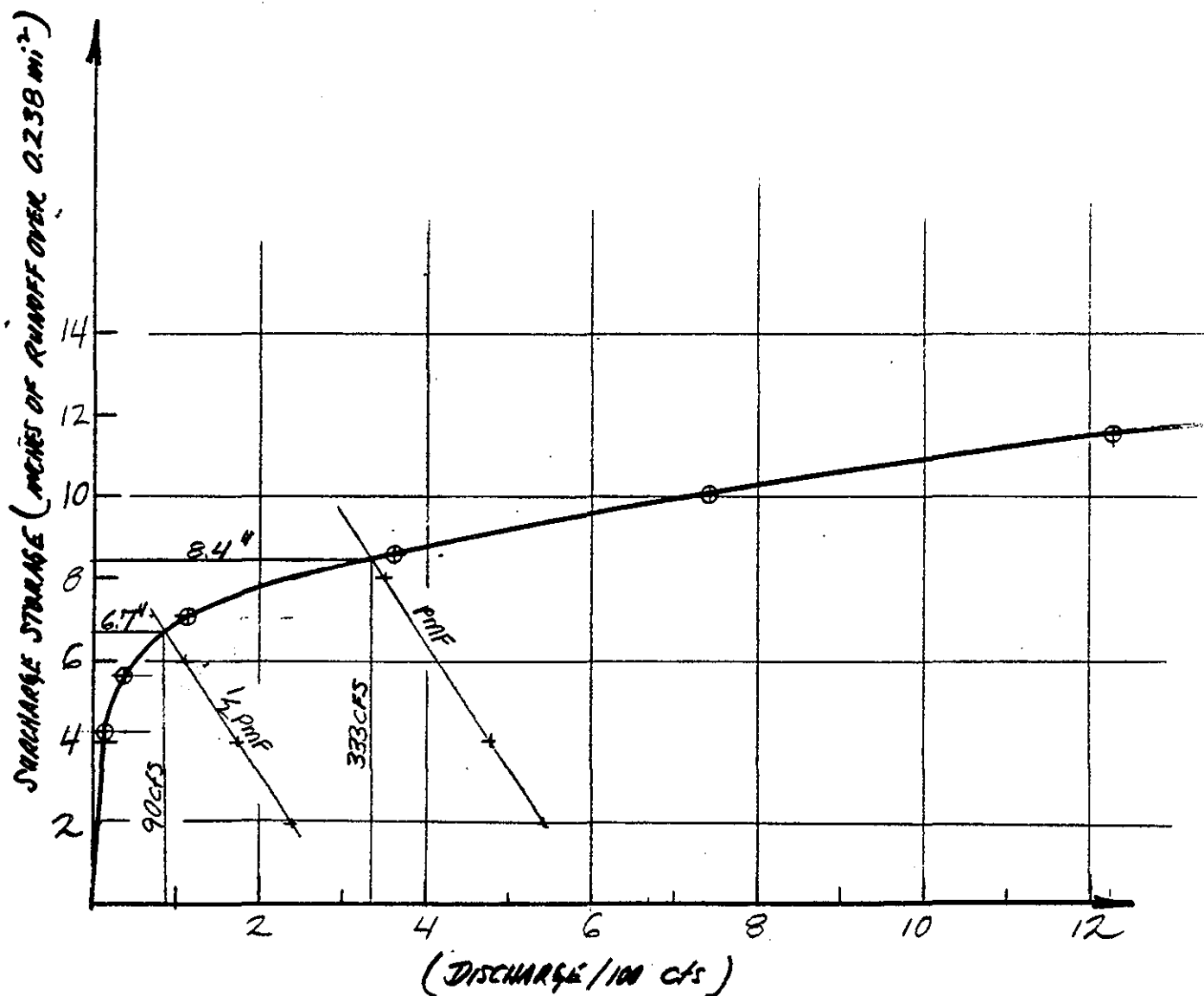
Project NATIONAL DAM INSPECTION PROGRAMContract No. 2616-025Sheet 11 of 22Feature WAUBEEKA LAKE DAMDesigned gFile No. 1

Item _____

Checked _____

Date 7-22-81

COMPOSITE STORAGE-DISCHARGE CURVE OF 3-DIKE RESERVOIR



STAGE STORAGE AT WAUBEEKA LAKE :

H	ELEVATION	INCHES (CUMULATIVE)
1	713	2.77
2	714	5.62
3	715	8.54
4	716	11.54
5	717	14.63
6	718	17.80





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Project NATIONAL DAM INSPECTION PROGRAM
 Feature WAHOKA LAKE DAM
 Item _____

Contract No. 2616-025Designed g

Checked _____

Sheet 12 of 22

File No. _____

Date 7-22-81

Date _____

DETERMINATION OF ROUTED INFLOW PMF PEAK AND $\frac{1}{2}$ PMF PEAKPMF:

$$Q_{P2} = Q_{P1} \left(1 - \frac{S}{19}\right)$$

$$Q_{P1} = .238 \times 2550^* = 607 \text{ cfs}$$

S	Q_{P2}
8	351
4	479
2	543

RESULTS: MAXIMUM RISE OF POOL; TO EL. 715.0 MSL
 FROM 712.0 MSL

MAXIMUM OUTFLOW Q ; 333 cfs

 $\frac{1}{2}$ PMF :

$$Q'_{P2} = Q'_{P1} \left(1 - \frac{S}{9.5}\right)$$

$$Q'_{P1} = 304 \text{ cfs}$$

S	Q'_{P2}
6	112
4	176
2	240

RESULTS: MAXIMUM RISE OF POOL; TO EL. 714.4 MSL
 FROM 712.0 MSL

MAXIMUM OUTFLOW Q ; 90 cfs

* BASED ON MOUNTAINOUS DA OF 2 mi².





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Project NATIONAL DAM INSPECTION PROGRAM
Feature WAUBESA LAKE DAM
Item _____

Contract No. 2616-025
Designed B
Checked _____

Sheet 13 of 22
File No. _____
Date 7-24-81
Date _____

STORAGE CURVE OF THE RESERVOIR, PAGE D-11 IN TABULAR
FORM, A STORAGE-DISCHARGE CURVE WAS OBTAINED, PAGE D-11.

3) SPILLWAY CAPACITY RATIO TO PEAK INFLOW & OUTFLOW.

THE CAPACITY OF THE 3' ϕ RCP CULVERT FLOWING FULL IS 35cfs.

% CAP. OF INFLOW PMF : 5.8%

" " " OUTFLOW " : 10.5%

" " " INFLOW $\frac{1}{2}$ PMF : 11.5%

" " " OUTFLOW " : 38.9%





Project

NATIONAL DAM INSPECTION PROGRAM

Feature

WAUBEKA LAKE DAM

Item

Contract No.

2616-025

Designed

B

Checked

Sheet

1A of 22

File No.

Date

7-24-81

Date

II DOWNSTREAM FAILURE HAZARD

1) POTENTIAL IMPACT AREA

THE POTENTIAL IMPACT AREA IS SHOWN ON ENCLOSED TOPOGRAPHICAL MAP, PAGE D-21. THE APPROXIMATE WATER LINE CREATED BY A BREACH THROUGH THE ROAD-EMBANKMENT DIKE IS ALSO INDICATED. ONLY TWO PRIVATE RESIDENCES IMMEDIATELY DOWNSTREAM OF THE CULVERT (100-200 FEET) WILL BE AFFECTED BY SEVERAL FEET OF WATER AROUND THE FOUNDATIONS, BUT NO WATER REACHING FIRST FLOOR ELEVATIONS.

2) FAILURE AT WAUBEKA LAKE DAM.

a) BREACH WIDTH

i) HEIGHT OF DAM: WAS TAKEN FROM MAXIMUM

RISE OF POND TO INVERT OF OUTLET: $715 - 709.54 =$

5.46'

ii) MID HEIGHT OF DAM = 2.73'

iii) APPROXIMATE MID-HEIGHT LENGTH = 84'

iv) BREACH WIDTH $.4(84) = 34$





Project

NATIONAL DAM INSPECTION PROGRAM

Feature

WAUBESA LAKE DAM

Item

Contract No.

2616-025

Designed

B

Checked

Sheet

15 of 22

File No.

Date

7-24-81

Date

b) PEAK FAILURE OUTFLOW

i) HEIGHT AT TIME OF FAILURE

$$715 - 709.54 = 5.46'$$

ii) SPILLWAY DISCHARGE AT TIME OF FAILURE:

$$Q_s = 35 \text{ cfs}$$

iii) BREACH OUTFLOW:

$$Q_B = \frac{8}{27} \sqrt{g} W_b Y_o^{\frac{3}{2}} \approx 730 \text{ cfs}$$

iv) PEAK FAILURE OUTFLOW

THE BREACH WILL INCLUDE THE SPILLWAY AND

THEREFORE THE PEAK OUTFLOW WILL BE 730 CFS

c) FLOOD DEPTH IMMEDIATELY D/S OF DAM

$$d = 0.44 Y_o = 2.4'$$

d) ESTIMATE OF D/S FAILURE CONDITIONS AT POTENTIAL IMPACT AREA.

THE DEPTH OF FLOW WAS COMPUTED FOR $n = 0.08$, FOR $Q = 730 \text{ cfs}$ THROUGH THE IMPACT AREA. IT WAS

EXPECTED (AND SUBSEQUENTLY VERIFIED) THAT THE

HAZARD WOULD BE LOW, AND DOWNSTREAM ROUTING



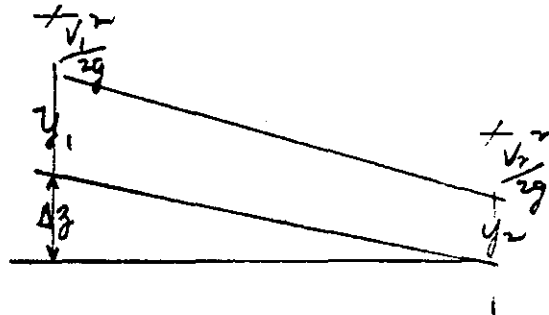


WOULD BE UNNECESSARY.

REPRESENTATIVE CROSS SECTIONS AND PROFILE ARE SHOWN ON
PAGE D-18.

TABULATIONS OF PERTINENT HYDRAULIC PARAMETERS ARE PRESENTED
ON PAGE D-19.

A MODIFIED STANDARD STEP APPROACH WAS USED AS FOLLOWS:



$$Q = \frac{1.486 A R^{2/3} S_f^{1/2}}{n} = K \sqrt{S_f} \quad (\text{MANNING}) \quad n = 0.08$$

$$h_L = \bar{S}_f L = \left(\frac{S_{f1} + S_{f2}}{2} \right) L = \frac{V_1^2}{2g} + y_1 + \Delta z - \frac{V_2^2}{2g} - y_2$$

$$\frac{V_1^2}{2g} = \left(\frac{Q}{A_1} \right)^2 \frac{1}{2g} = \left(\frac{K_1}{A_1} \right)^2 \frac{S_{f1}}{2g}$$

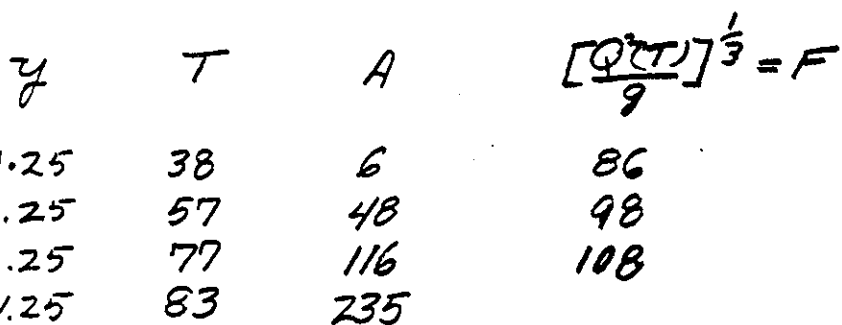
$$y_1 + \Delta z + \left[\left(\frac{K_1}{A_1} \right)^2 \frac{1}{2g} - \frac{L}{2} \right] S_{f1} = y_2 + \left[\left(\frac{K_2}{A_2} \right)^2 \frac{1}{2g} + \frac{L}{2} \right] S_{f2} = y(y_2)$$

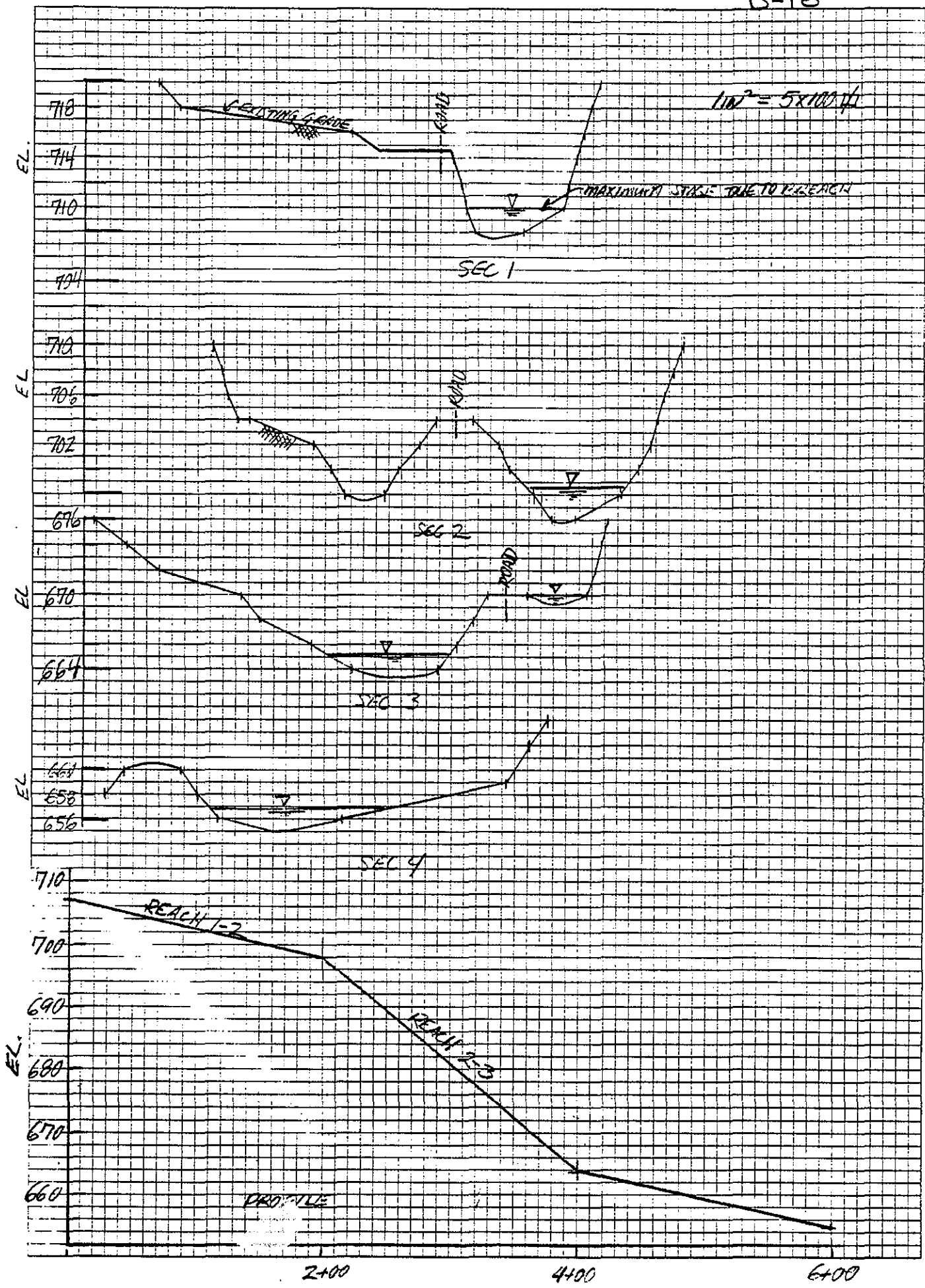
$$S_{f1} = \left(\frac{Q}{A_1} \right)^2$$

ASSUMED THAT FLOW PASSES THROUGH CRITICAL DEPTH IN SEC-1.

$$A = \left[\frac{Q^2(T)}{g} \right]^{1/3}$$









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Project NATIONAL DAM INSPECTION PROGRAMFeature WAUKEGA LAKE DAM

Item _____

Contract No. 2616-025Designed B

Checked _____

Sheet 19 of 22

File No. _____

Date 7-24-81

Date _____

SEC 1

EL	y	A	K	$(K/A)^{2/29}$	$\gamma(y)$
709.6	2.1	98	2274	8.37	13.26

SEC 2

EL	y	A	K	$(K/A)^{2/29}$	$\gamma(y)$
697	1.2	34	537	3.97	193
698	2.2	100	2387	8.90	12.39
699	3.2	181	5568	14.65	5.17

SEC 3

EL	y	A	K	$(K/A)^{2/29}$	$\gamma(y)$
664	0.5	23	202	1.24	1320
	1.4	84	1490	4.89	26.6 *
665	1.5	91	1690	5.36	21.2
667	3.5	327	10660	16.56	4.05
666	2.5	187	4870	10.58	4.98

SEC 4

EL	y	A	K	$(K/A)^{2/29}$	$\gamma(y)$
656	1	64	907	3.12	67.8
656.8	1.8	156	3270	6.83	7.12
657	2	187	4200	7.86	5.26
658	3	—	—	—	—





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NATIONAL DAM INSPECTION PROGRAM

Feature

NAUGLEKA LAKE DAM

Item

Contract No.

2616-025

Designed

B

Checked

Sheet

20 of 22

File No.

Date

7-24-81

Date

REACH 1-2:

$$y_1 + (697.5 - 695.8) + (8.37 - 100) \left(\frac{730}{2274} \right)^2 = 4.36$$

INTERPOLATING AT SEC-2, $y_2 \approx \underline{\underline{2.2'}}$

EL 698

 $y_1 = 2.2$

A 100

K 2387

 $(K/A)^{1/2} h_g = 8.90$ $\psi(y) = 12.4 \approx 13.3$ REACH 2-3

$$y_2 + (695.8 - 663.5) + (8.90 - 100) \left(\frac{730}{2387} \right)^2 = 26.0$$

$$y_3 = \underline{\underline{1.4'}}$$

 $A_3 = 84$ $K = 1490$

$$(K/A)^{1/2} h_g = 4.89$$

$$\psi(y) = 26.6 \approx 26.$$

REACH 3-4

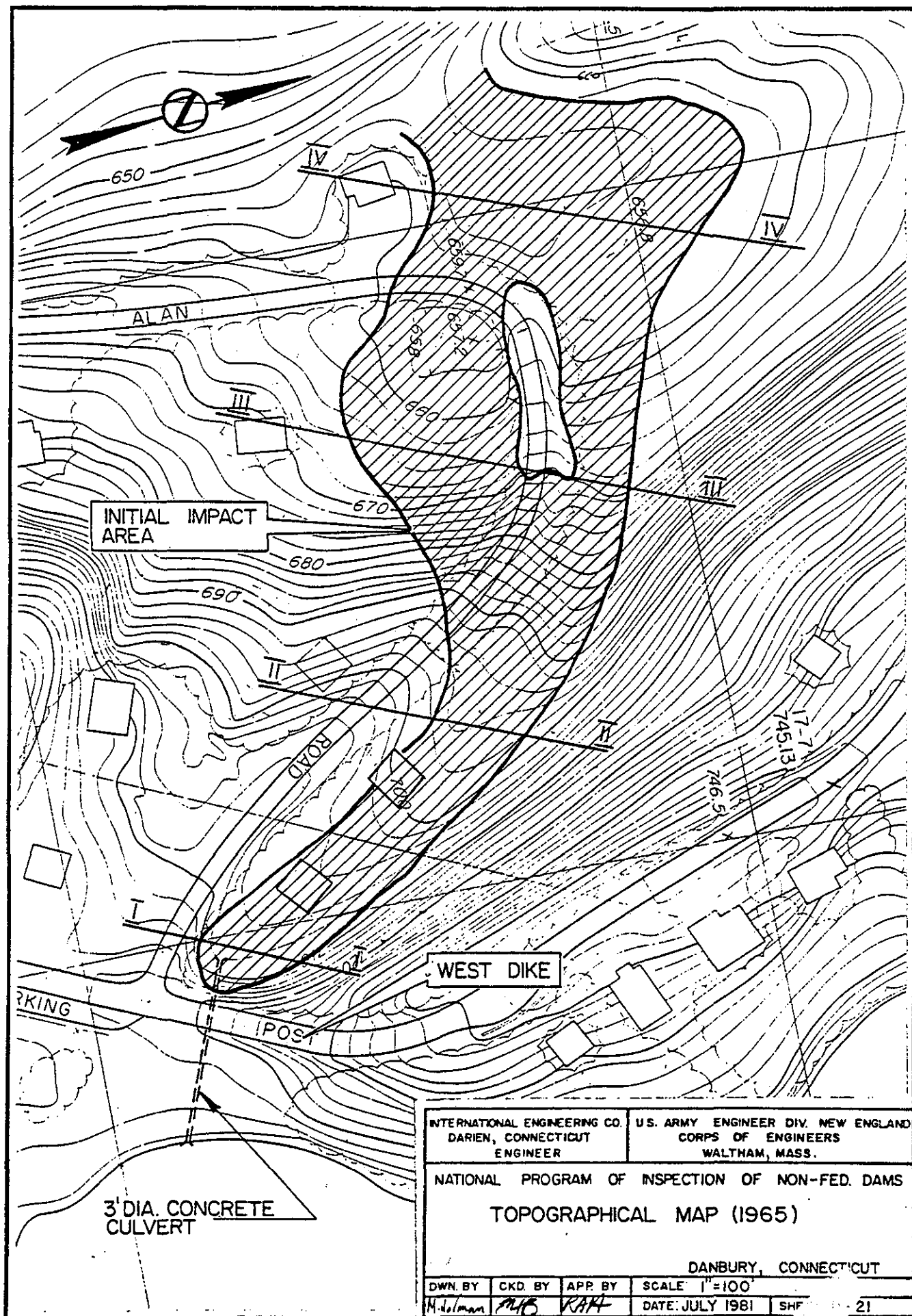
$$-y_3 + (663.5 - 655) + (4.89 - 100) \left(\frac{730}{1490} \right)^2 = -12.9 \quad \text{SINCE HYDRAULIC JUMP}$$

$$\text{ASSUME } \sqrt{f_3} = \sqrt{f_4} = \sqrt{f_0} = .0425 = \left(\frac{Q}{K} \right)^2$$

$$K = 3540$$

$$y_3 \approx \underline{\underline{2.1'}} \quad y_4 \approx \underline{\underline{1.9'}}$$





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NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS				
TOPOGRAPHICAL MAP (1965)				
DANBURY, CONNECTICUT				
DWN. BY	CKD. BY	APP. BY	SCALE	1"=100'
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Feature

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Item

Contract No.

2616-025

Designed

B

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Sheet

22 of 22

File No.

Date

7-24-84

Date

III SELECTION OF TEST FLOOD

MAXIMUM RISE OF WATER SURFACE FROM CHANNEL -

OVERLAND INVERT IS 2.2'. MINIMUM HEIGHT OF

FIRST FLOOR OF HOUSE IN POTENTIAL IMPACT AREA IS

3 FEET. THEREFORE; NO DAMAGE WILL RESULT.

a) SIZE < 130 AC-FT

∴ SMALL

HEIGHT = 6' (BASED ON MAXIMUM RISE OF W/S.)

b) HAZARD POTENTIAL: BASED ON BREACH ANALYSIS;

LOW

